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The Use of Games to Facilitate the Learning of Basic Number Concepts in Preschool Educable Mentally Retarded Children. Final Report.

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Group games were used to teach basic number concepts to educable mentally retarded children. The number concepts were integral but incidental to the intentional teaching of game skills. Subjects were 21 boys and 19 girls from eight classes, free of gross defects (means were IQ=66.22, age=7.9, mental age=5.11), and matched in pairs for chronological age, mental age, IQ, and scores on pre-experimental tests of number concepts, game skills, preference for social play, and voluntary social participation in school. The experimental group of 20 participated 100 minutes a week in a 9-month game program; the control group, also 20, attended a traditional math program; and both were tested at the middle and end of this period. The experimental group scored higher on both mid-experimental ($p<.003$) and post-experimental ($p<.0003$) measures on the Number Knowledge Test (test reliability=98% on Form A and 93% on Form B), higher on the post-experimental measure ($p<.002$) on the spontaneous use of quantitative terms, and made fewer errors on both the mid-experimental ($p<.005$) and post-experimental ($p<.0005$) tests on General Game Skills (test reliability=91%). Game and modeling procedures and attention directing variables (use of excitement and rewards) are suggested as teaching techniques for retarded children. , and a handbook for teaching game skills is included. (Author/SN)

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Stanford, California

December, 1967

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SUMMARY

The purpose of this research was to determine whether small group games could be used to facilitate the learning of basic number concepts in young, educable, mentally retarded children. The distinguishing feature of the game program used here was the emphasis upon the acquisition of social competence in the form of general game skills with basic number concepts being an integral part of the activity but incidental to the intentional teaching of game skills.

The subjects (Ss) were matched in pairs on the bases of CA, IQ, MA, and pre-experimental measures of knowledge of number and game skills. One member of each pair was randomly assigned to the Experimental Group (n=20), the other member was placed in the Control Group (n=20). The Experimental Group Ss participated for 100 minutes per week in a nine-month game training program in which the intentional teaching was general game skills with the manipulation of numbers being an intrinsic part of the game activity. The Control Group Ss spent an equal amount of time in traditional arithmetic programs. Midexperimental and post-experimental measures of knowledge of number and general game skills were obtained on all Ss.

It was hypothesized that as a result of participation in the game program the Experimental Group Ss would show a marked improvement in knowledge of number and in general game skills. The data provided strong support for the facilitative effects of the game program on the learning of number concepts and game skills: the Experimental Group Ss obtained significantly higher scores on both measures than did the Control Group Ss.

It was concluded that small group games of a relatively complex nature can be used to teach basic number concepts to retarded children. It was recommended that game procedures be incorporated into the curriculum and that modeling procedures and attention-directing variables be used in teaching retarded children.

INTRODUCTION

To function effectively in our society a child should understand basic number concepts and develop simple computational skills. The preschool child of normal intellectual ability begins to acquire a knowledge of number partly as a result of intentional training by his parents and preschool teachers, but primarily through the process of incidental learning from play activities, picture books, television, and other experiences (5, 8, 33). Typically when this child enters school he can enumerate objects, use simple quantitative terms, count by rote to ten or more, and perform some simple addition and subtraction tasks with concrete objects (7, 32). As a result of his knowledge of number, he is able when he is six years old to begin an arithmetic readiness program with formal paper and pencil instruction.

In contrast, the retarded child has little knowledge of number when he enters school. The major reason for the difference in number knowledge between the normal and the retarded child is that the retarded child learns beginning number concepts later than does the normal child, this lateness being related to his slower rate of intellectual development (15, 29). As a result he is not ready to begin an arithmetic readiness program until he is eight or nine years old.

The difference between the normal and the retarded child in rate of intellectual development does not completely account for the retarded child's slower acquisition of number knowledge. Two other important causative factors are deficits in the environment of the retarded child (24) and in his performance in ordinary learning situations (23). These two deficits have particular relevance to the development of special programs for the retarded child because each is potentially far more amenable to correction than is his slow rate of intellectual development.

The environment of the retarded child: The retarded child typically lacks formal and informal number experiences. Adults tend to markedly underestimate his ability to profit from intentional training (24,28), and as a result the intentional training that he does receive is at a lower level than his intellectual potential would indicate. His contacts with adults other than his parents are limited because he is unlikely to attend preschool (5, 24). The retarded child also has fewer incidental learning experiences with numbers than does the normal child. He does not function well in most game situations. Physical clumsiness makes him inept and his slower rate of intellectual development makes participation in games that require simple counting, naming, and remembering impossible for him. The standard childhood books are often too difficult for him to enjoy and he is unable to attend to and understand most audio-visual presentations (5, 24).

The performance of the retarded child: Recent experimental investigations of the learning capabilities of the retarded child show that even when opportunities to learn do occur he is unable to benefit from them and perform at a level appropriate to his ability. Despite the fact that he is capable of intentional and incidental learning the retarded child generally fails to reach his potential on both kinds of learning task (4, 17, 23). There is unequivocal evidence that he has a performance deficit in ordinary learning situations.

Denny (17) has suggested that the discrepancy between the potential and the performance of the retarded child occurs because he does not respond consistently in an ordinary learning situation. The retarded child does not learn because he responds to the stimulus of the moment rather than to internal maintaining stimuli or sets. This explanation stems from elicitation theory, the basic tenet of the theory being that consistent or repeated responding is necessary for learning to occur. Denny contends that the retarded child would respond consistently and learning would occur with special training techniques such as rewards, appropriate instructions, special devices such as teaching machines, and long term training to teach the child to attend to verbal stimuli (17).

The training techniques that Denny suggests undoubtedly would facilitate learning in any children whether retarded or normal (14, 16). However, we propose that a more effective approach having greater potential for growth is a training technique that emphasizes the specific psychological functions in which the retarded child is deficient. Many aspects of the retarded child's life are affected by his deficits in psychological functioning and in academic content. The type of training technique that we are proposing would provide the child with an opportunity to develop competence in some psychological function in which he is deficient and, at the same time, would allow him to acquire academic content that he lacks.

In the present study the lack of social competence that is characteristic of most young retarded children provided the framework for the development of a training technique designed to teach them basic number concepts. The number concepts content was presented within the context of the small group game. In keeping with the emphasis on social competence, the intentional training in the game situation was concerned with general game skills, there was little or no direct teaching of number concepts. Instead, the manipulation of number became an intrinsic part of the game activities, it was a means to an end, *i.e.*, playing the game, rather than an end in itself.

Other investigators (11, 13, 18, 19, 25, 31) have used game procedures to teach arithmetic to retarded children. These investigators have placed the primary emphasis on the intentional teaching of number concepts in activities that were often techniques for presenting the number content rather than games. The characteristics that distinguish games from many other forms of learning activity were not systematically used, there was little evidence of excitement, competition, chance, and noisy fun in the descriptions they provided of their game activities. The distinguishing feature of the training technique developed in the present study is the intentional teaching of general game skills with the learning of basic number concepts being an incidental part of the game activities. Three other characteristics that distinguished our game procedures from those of other investigators were the use of adult models as rule-breakers, the use of multiple rewards to emphasize the meaning of winning, and the systematic manipulation of excitement as an attention-directing variable.

The use of adult models: Playing games correctly involved a tremendous amount of learning on the part of the retarded children. In order to divert criticism from the children while at the same time drawing attention to their errors, an adult model participated in the game activities as a regular player and broke those rules that were causing the children the most difficulty. The game controller verbally reprimanded the adult model for her errors, insisted that she immediately exhibit the correct behavior, praised her for the correction, and encouraged the children to "help her learn to play the game."

A second important effect of the use of adult models was the reduction in number of errors made by the children. Empirical evidence for the efficacy of this modeling procedure is found in studies of the effects of punishment of a model upon the subsequent behavior of young normal (2) and retarded (34) children. There is unequivocal evidence from these studies that the consequences of responses to a model serve as cues indicating the permissibility or nonpermissibility of reproducing the model's behavior in the same, or a similar context. If an observer sees a model punished for a specific response the probability that the observer will exhibit the punished response is markedly reduced; if the observer sees the model rewarded for making the correct response, the probability is increased that the observer will also exhibit that response at the appropriate time.

The use of rewards: One major characteristic of childhood games is that one individual (or one team) is the winner and the remainder of the group (or teams) are automatically the losers. The winner is clearly identified by the fact that he receives one or all of the following kinds of reward: tangible rewards (he acquires possessions from the other players, has some advantage when play is resumed, or wins a prize), symbolic rewards (his winning is recorded where all players can see it), and praise (he is publicly commended). Retarded children generally have little experience as winners because they tend to be excluded from the neighborhood play groups and to be protected from failure in the school setting (12,22, 26). In the latter case they do not experience winning because there are no losers. In the special class all players tend to be rewarded for their performance regardless of who actually won or lost.

In the present study tangible and symbolic rewards and praise were used to teach the child the meaning of winning and losing. The procedure was to use praise to emphasize winning and also to give the winners symbolic rewards that could, in turn, be exchanged for tangible rewards. The game controller encouraged the children to anticipate winning whenever it was appropriate to do so. Empirical evidence for the efficacy of multiple rewards with retarded children has been provided by Birnbrauer, Bijou, and Wolf, and by Hunt and Patterson (17). The results of a number of studies of incentive manipulation with older retarded children have shown that a combination of rewards produces higher learning scores than does a single reward (17).

A second important effect of the rewards was to develop a positive attitude to number activities by heightening the enjoyment of the game activities for the children. The basis for this statement is contained in secondary reinforcement theory and experimentation (16). According to this theory, if a neutral object is consistently associated with a rewarding state of affairs, the neutral object will, in time, come to have reward value in itself. It would follow that if numbers, which are presumably neutral objects, are repeatedly associated with pleasurable game activities, the numbers should come to have reward value for the retarded child.

The use of excitement: Childhood games are frequently characterized by a particular kind of excitement which distinguishes them from most other forms of learning activity. Systematic use was made of excitement to focus the children's attention on the game activities. Many of the games involved pursuit, races, close finishes, escape, sudden disaster, rescue, and exciting characters. The game controller heightened the feeling of excitement with suitable comments whenever it was appropriate to do so.

Theoretical support for the facilitative effects of attention-directing variables upon learning is contained in the elicitation theory of Denny and Adelman(17). These theorists state that learning will take place if consistent responding occurs and stress the importance of special techniques that will elicit consistent responding from a retarded child in a learning situation. Bandura and his associates (2, 3) have also emphasized the importance of attention-directing variables in their studies of observational learning.

The present research was designed to determine whether small group games could be used to teach basic number concepts to retarded children. The essential feature of the games was an emphasis on social behavior in the form of general game skills with number concepts being an integral part of the activity but incidental to the intentional training in general game skills. The subjects in the Experimental Group participated in a nine-month training program in which they learned to play small group games that required the manipulation of numbers. The subjects in the Control Group spent an equal amount of time in traditional primary classroom arithmetic programs. To avoid a Hawthorne effect, the Control Group spent the same amount of time with the experimenters as did the Experimental Group in an enjoyable, but unrelated, research activity.

The subjects were assessed prior to the nine-month experimental period on the following behaviors: knowledge of number, general game skills, stated preference for social rather than solitary play, and voluntary social participation in the school setting. It was hypothesized that as a result of participation in the games program, the subjects in the Experimental Group would show a marked increase in their knowledge of number and in their general game skills, and would show an increased preference for social play and an increased tendency to engage in voluntary social participation in the school setting.

METHOD

Subjects: The subjects (Ss) were 21 boys and 19 girls from four preschool and four primary classes for the educable mentally retarded in Santa Clara and San Mateo Counties in Northern California. All Ss were free of gross motor, sensory, and emotional defects and were not on any medication that could influence their learning ability. The Ss ranged in chronological age (CA) from four years, five months, to nine years, 11 months, with a mean of seven years, nine months, and a SD of 18.37 months. Their IQ's on the Stanford-Binet Intelligence Test, Form L-M, or other equivalent measure, ranged from 51 to 79, with a mean IQ of 66.22 and a SD of 8.65. The Ss' mental ages (MA) ranged from three years, one month, to seven years, three months, with a mean of five years, 11 months, and a SD of 13.34 months.

General Procedure: Four measures of behavior were developed to evaluate each of the 40 Ss prior to any experimental manipulations and to assess each S once during and again at the end of the experimental period. These four measures were used to assess the Ss' knowledge of basic number concepts, their general game skills, their stated preference for social rather than solitary play, and their voluntary social participation in the school setting. The 40 Ss were matched in pairs on the bases of their scores on each of the four measures listed above and their CA, IQ, and MA. One member of each pair was randomly assigned to the Experimental Group (n=20), the other member was automatically placed in the Control Group (n=20). The two groups did not differ on the four measures of behavior, their scores on these measures are presented later in this report. There were no differences between the two groups on CA (Exp. M=92.20 mos., SD=19.18; Cont. M= 93.40 mos., S.D.=18.03), on IQ (Exp. M=67.10, SD=8.08; Cont. M=65.35, SD=9.32) or on MA (Exp. M=60.49, SD=10.65; Cont. M=61.50, SD=15.85).

Following the pre-experimental testing program each S in the Experimental Group participated for 100 minutes per week in a nine-month games program. The Ss in the Control Group spent the same amount of time in a regular special classroom arithmetic program. All 40 Ss were assessed once during the nine-month experimental period and again at the end of this period on the four measures of behavior which are described in detail as follows:

1. The Number Knowledge Test: The purpose of this test was to assess the S's knowledge of some of the basic number concepts that are generally included in the material taught in the first grade. The Number Knowledge Test was adapted from Brownell and Weaver (7), Grossnickle and Brueckner (21), and Marks, Purdy and Kinney (32).

Content. The test included items designed to measure rote and rational counting, one-to-one correspondence, understanding of specific quantitative terms, concepts of numbers from one to five, recognition of groupings from two to five, identification of time measuring instruments, telling time, identification of money, knowledge of the absolute and relative value of different coins, shape identification, color recognition and spontaneous use of quantitative terms.

Two forms of the test were developed. The longer form, Form A, contained 134 items, the shorter form, Form B, contained 25 items.

Administration. Form A was administered to each S once before the nine-month game training program began and again immediately following the program. Form B was administered to each S once during the program. The S's scores on these three administrations will be referred to as pre-experimental, postexperimental, and midexperimental, respectively.

Because of the length of Form A, each S was encouraged to tell the tester when he would like to stop playing "this counting game" and play some other game. This procedure was used to eliminate fatigue and boredom effects. When a S stated that he would like to stop, the testing was resumed on the following school day. Form B was administered to all Ss in a single session.

Scoring: The items on the Number Knowledge Test yielded two scores. The first score represented the S's performance on all items except ten picture story items designed to measure the spontaneous use of quantitative terms. This first score was called the Number Knowledge Score. The total possible Number Knowledge Scores that a S could obtain were 158 on Form A and 44 on Form B.

The second score was the number of quantitative terms that the S used in telling stories about ten colored pictures. This second score was referred to as the Spontaneous Quantitative Vocabulary Score. There was no definite limit to the total possible score on these picture stories, the Ss' (n=40) pre-experimental scores ranged from zero to 84. This score was kept separate from the Number Knowledge Score because if the two scores were combined high verbal ability in a S could spuriously raise his Number Knowledge Score. There were no differences between the Experimental and Control Groups on the following measures of verbal ability: verbal performance on the Stanford-Binet, Form L-M, verbal performance on incomplete stories in a previous experiment, and total number of words used on the pre-experimental measure of Spontaneous Quantitative Vocabulary.

Reliability. The reliability coefficient for the Number Knowledge Score on Form A was .98 and on Form B was .93, and for the Spontaneous Quantitative Vocabulary Score on Form A was .81 and on Form B was .84. The reliabilities of the subscores are contained in Appendix A. The method of estimating reliability consisted of administering the identical test twice to a selected group of Ss (n=10). To select these ten Ss the total scores of all the Ss (n=40) on each of the measures above were ordered from high to low and every fourth S participated in the reliability tests. The first and second testings took place within two weeks in order to minimize the possible effects of intervening factors. It is unlikely that taking the test the first time resulted in any learning because the tester did not indicate whether the S's answers were correct. No S showed any interest in whether his answers were correct.

Observer reliability was determined by the percentage agreement method. An agreement was counted whenever both observers recorded the same response on the test form. Zero entries by both observers were not counted as agreements. An omission by one observer when the other observer recorded a response was counted as a disagreement. Observer reliability for the Number Knowledge Score on Form A was 97 per cent and on Form B was 99 per cent, and for the Spontaneous Quantitative Vocabulary responses on Form A was 92 per cent and on Form B was 95 per cent. The main source of disagreement was the failure of the Ss to speak distinctly. Many of the observer disagreements on the Spontaneous Quantitative Vocabulary items did not involve quantitative terms.

Appendix A contains copies of the Number Knowledge Tests-Forms A and B together with instructions for their administration and scoring.

Observers: The observers were students in Psychology, Medicine and Education who were trained to assist in the testing. The observers knew that this project was concerned with number concepts but they were naive as to the experimental status of the Ss. Because the schools do not have one-way vision mirrors, the observers were in the experimental room. However, the Ss in the eight classes were all accustomed to having adults around and showed little or no interest in the observers.

2. General Game Skills: The purpose ot this measure was to assess the skills the S exhibited in small group games, the emphasis being on the general game skills that are prerequisite to successful participation in the small group games of childhood.

Content. The following behaviors were included: behavior while the game controller was explaining how to play the game, playing in turn, taking only one turn, behavior between turns, handling the game materials only at appropriate times, handling the game materials with reasonable care, observing specific rules of the game, being a good loser, accepting decisions of the game controller, and accepting that the game was over.

Procedure. The experimenter (E) invited three children who were socially compatible to come to the experimental room to play a game. Two of the children were Ss, the third child was a classmate. The E showed the children the game and explained how it was played. Next, she showed them their scorecards and explained how they were used and told the children that they would win prizes if they were able to fill their scorecards. The E showed the children the prizes and allowed them to examine and discuss the prizes. The three children then participated in a practice game which lasted for five minutes of actual playing time, i.e., whenever a player made an error the timing of play stopped while the E explained the error. Explanation time was timed separately in order that the observers might observe the Ss' behavior while the E was explaining the game and record instances of misbehavior. Behavior while the game controller (E) was explaining the game was one of the ten General Game Skills used to assess the Ss. The ideal time for assessment of this skill was during this practice game period because the E engaged in a lot of explanation.

At the end of the practice game the E briefly reviewed the rules and play began. Each of the two Ss was observed for two consecutive five-minute periods. The E controlled the game's outcome, each child won at least once on any one day. During these games the E intervened only when it was necessary to keep the game going. Play ended for the day when each S had been observed for two consecutive five-minute periods. Play was resumed on the following school day with the same threesome playing the same game. Each of the two Ss was observed again for two consecutive five-minute periods. The conditions of play were the same as for the first day except that there was no practice game.

Each S then played a new game in a new threesome and was observed for a total of four five-minute periods on two different days. The procedure used in this second game was the same as that described above for the first game.

The same procedure was followed to obtain four more five-minute periods of observation of the S playing a third new game in a third new threesome. At the conclusion of this period of play each S had been observed for a total of 12 five-minute periods of play with three different games and in three different threesomes. The games used were ones the children had never seen.

In the midexperimental testing period the same general procedure was followed to obtain two five-minute periods of observation of each S playing one game in a threesome of players. In the postexperimental testing period the procedure used was identical to that used in the pre-experimental testing period, *i.e.*, in the postexperimental testing period each S was observed for a total of 12 five-minute periods of play with three different games and in three different threesomes.

Scoring. The S's score on the General Game Skills measure was an error score, the observers recorded a tally in the appropriate category each time the S made an error on any of the ten game skills listed above under *Content*.

Reliability. Observer reliability on the General Game Skills measure was 91 per cent. The main sources of disagreement occurred in three categories: handling the game materials with reasonable care, observing specific rules of the game, and accepting that the game was over.

Appendix B contains a copy of the General Game Skills Rating Form, the definitions of the ten game skills, and a description of the three pre-experimental, the one midexperimental, and the three postexperimental games used in the assessment of the Ss' game skills.

3. Voluntary Social Participation: The purpose of this measure was to assess the kind of social participation, if any, that the S exhibited in the school setting.

Categories. The following kinds of behavior were observed: verbal, cooperative play, general play, and preference for group or solitary play.

Procedure: To assess the kind of social participation that the S exhibited, each S was observed for 12 five-minute periods and each instance of social participation or the absence of social participation by the S during that period was recorded in the appropriate category on the score sheet. Because the opportunity for social participation varied considerably depending on the kinds of available activity and play materials, four observations were made in each of the following school settings: experimental room, classroom, and playground. The five-minute period of observation began when the S was leaving one setting and entering another setting where social participation was optional. For example, each S was observed when he left his car or the school bus and entered the playground area, when he left the classroom and went outside for unsupervised activity in the recess period, when he finished his assigned work in the classroom and could go to any part of the classroom free play area, and when he completed a task in the experimental room and was offered a choice in which both group and solitary play were possible.

Scoring: If the S voluntarily engaged in verbal or social play behavior during the five-minute period he was assigned a score of three, if he participated immediately after he was addressed or directed or encouraged to join in a group activity he was given a score of two, and if he did not engage in any social participation when there were no visible barriers to it he was given a score of one.

Reliability: Observer reliability was 92 per cent. There were two main sources of disagreement. Ss often talked in physical proximity to another child and it was not clear whether they were talking aloud to themselves or whether they were actually engaging in social conversation with the other child. Some Ss were present in a cooperative play situation but acted as if they were engaged in parallel play. Where disagreements occurred the observers discussed the sequence of behavior and decided how to score it.

Appendix C contains a copy of the Social Participation Scales.

4. Preference for Social vs. Solitary Play: The purpose of this measure was to assess the S's stated preference for social or solitary play by means of one situational test and two projective techniques.

Procedure: In the situational test the S was shown several attractive sex-appropriate toys that were suitable for either social or solitary play and was offered the choice of playing with them alone or inviting another child, or other children, to play with him. This test was administered in three settings: playground, classroom and experimental room. Three different toys were used in each setting on three different days. The boys' toys were a farm set, multi-shaped building blocks, a set of racing cars with a track, a set of boats in water, a train game, a marble game, a target kit, a Batman Kit with dress-up clothes, and a set of guns and army equipment. The girls' toys included the following: a tea set with table and chairs, a set of dolls with bathtubs, a doll house with dolls and furniture, a set of rubber balls, a cooking set with food mixes, a coloring game, dress-up clothes for three people, a block game and a maze floor game.

The first projective technique used was doll play. The S was shown a series of five structured situations in which a same-age, same-sex doll was offered a choice between social and solitary play activities. The S was asked to show the tester which of the two types of activity the doll chose. The order of presentation of social and solitary play was varied according to a prearranged schedule. The doll play situations were administered in a single session. Two practice items were given first to familiarize the S with the doll play procedure.

The second projective technique used was a set of incomplete picture stories. The S was shown a series of picture stories in which a same-age, same-sex story child was placed in a number of choice situations concerning social *vs.* solitary play. The S was asked to select the picture which showed the type of activity the story child chose. The placing of the pictures depicting social and solitary play was varied according to a prearranged schedule.

Scoring. The observer recorded the S's responses to each of the situations.

Reliability. Observer reliability was 99 per cent. The only source of error was indistinct verbalizations by the Ss.

The retest reliability was unsatisfactory on all three measures. In the situational tests the older Ss (n=6) in the randomly selected reliability group of ten Ss qualified their answers to such an extent that it was impossible to decide whether they preferred social or solitary play although they stated that they preferred social play. The younger Ss (n=4) fluctuated, they usually stated a preference for social play and then almost immediately reversed their decisions.

With the two projective techniques the Ss generally exhibited a "toss the coin" reaction. For example, they would make the following kinds of statements: "I think I'll have him play alone today because he's been bad." "He can play with these boys this time and next three times he gets to play alone." "What should he do, he should play with them this time and not with them next time and with them next time."

Appendix D contains a copy of the Preference for Social vs. Solitary Play Scoring Sheet, instructions for the administration of the three measures used, a list of the toys used in the situational tests, the details of the doll play situations, and a description of the picture materials used in the picture stories.

Game Training Program: Following the above extensive pre-experimental testing program each S in the Experimental Group participated in game activities for 100 minutes per week for nine months. The Game Training Program is described in detail in Appendix E. The general characteristics of the Program are described as follows:

(1) Number level. On the basis of his performance on the Number Knowledge Test each S was assigned to an appropriate number level defined as the point at which he could successfully perform with number concepts.

(11) Game level. The game level refers to the number of general game skills the S possessed. Each S was assigned to an appropriate game level on the basis of the observations made of his pre-experimental game behavior. For example, a S who was able to play in turn and to take only one turn was at a different game level from a S who consistently made errors on these two general game skills.

(111) Length of game. Because the Ss had short attention spans the length of the games at the beginning of the Game Training Program was seldom more than two minutes. As the Ss'attention spans increased, the length of the games also increased. By the end of the Program most Ss were able to play games that lasted 12 minutes.

(IV) Introduction of game skills. Since most Ss had little or no knowledge of the general game skills, only one skill was emphasized during the playing of a game at the beginning of the Program. For example, playing in turn was the second game skill taught. In playing a game great emphasis would be placed on each S's playing in turn. If the S made other errors such as handling the game materials roughly the E stopped the behavior when it occurred but she did not emphasize it.

(V) Use of models. One adult (E) worked consistently with the Ss in each school. A second adult the adult model (AM) served as a player who made errors. This procedure allowed the E to emphasize particular errors without directly criticizing the Ss. The Ss were encouraged to "help" the AM thus causing them to attend to the games and to engage in overt and covert rehearsal of the game skills and specific rules.

The Ss also served as models for other Ss. If one S was having difficulty with a particular game skill he was assigned to a game group in which the other two or three Ss had mastered that particular game skill, the E then praised the other Ss whenever they exhibited that game skill thus emphasizing the skill to the S who has having difficulty with it.

(VI) Scorecards and rewards. Each S was given a scorecard upon which a star was recorded each time the S won a game. At the beginning of the Program there were 16 spaces on the scorecard. As the Program progressed.

the number of spaces on subsequent cards was increased to 24, 48, and 64 depending upon the CA and general social maturity of the S. When the S had a full scorecard he won a small tangible reward.

(VII) Attention-directing variables. The presence of adult models and the use of scorecards and rewards served to direct the attention of the Ss to the game. In addition, certain characteristics of the games themselves served to focus the S's attention on the ongoing play. The games were visually attractive, exciting, and appropriate for both the age and sex of the Ss.

(VIII) Rules. As the Ss increased in competence in the general game skills the E encouraged them to make changes in the specific rules of a game and to suggest additional rules to make the game more exciting. The E also encouraged the Ss to make up new games.

(IX) Leadership. As the Ss increased in competence they also became more confident. The Ss were allowed to act as game controllers as soon as they were adequately competent on most of the general game skills. The E always remained in the experimental room but as the Program progressed she was able to withdraw completely from many of the game situations. The E intervened only in the case of major disruptions, she let the Ss settle minor disagreements themselves.

Midexperimental Testing. The Ss in both groups were tested once during the nine-month experimental period, this testing occurred in the fifth month. All Ss (n=40) in the Experimental and Control Groups were given the Number Knowledge Test - Form B and were assessed in two five-minute periods on their general game skills.

Postexperimental Testing. Immediately following the completion of the nine-month experimental period all Ss were given the Number Knowledge Test - Form A and were assessed in twelve five-minute periods on their general game skills.

RESULTS

The results of this experiment provide strong support for the efficacy of a game training program that emphasizes the intentional teaching of general game skills with basic number concepts being an integral part of the activity but incidental to the intentional training. The Number Knowledge Test scores of the Experimental Group were higher than those of the Control Group on both the midexperimental (t=3.47, p<.003)* and the postexperimental (t=5.49, p<.0003)** measures. It is reasonable to attribute the gains in the scores of the Experimental Group to the game training program because there were no differences between the two groups on the pre-experimental Number Knowledge Test. Within-group comparisons of the pre- and postexperimental Number Knowledge Test scores showed a more substantial increase in the scores of the Experimental Group than of the Control Group: the pre- and postexperimental means for the Experimental Group were 87.10 and 134.80 respectively, (t=9.87, p<.0001)** and for the Control Group were 90.30 and 102.10 respectively, (t=5.54, p<.0003)** Tables 1, 2, and 3 contain the comparisons of the total scores and of the subscores of the two groups on the pre-experimental, midexperimental, and postexperimental Number Knowledge Tests.

Further evidence for the efficacy of the game training program is provided by the picture story measures of the spontaneous use of quantitative terms. On the pre-experimental and midexperimental measures of this variable there were no differences between the Experimental and Control Groups. However, on the postexperimental measure, the Experimental Group used more quantitative terms (t=3.58, p<.002).** Within-group comparisons of the pre- and postexperimental spontaneous quantitative term scores showed a marked increase for the Experimental Group (t=3.65, p<.002),** but no differences for the Control Group.

The data provide substantial support for the hypothesis that a marked improvement would occur in the general game skills of the Experimental Group as a function of participation in the game training program, improvement being defined as a reduction in the number of errors made while playing games. On the pre-experimental measure of general game skills, the groups did not differ in number of errors. However, the groups showed marked differences on the subsequent measures, the Experimental Group making significantly fewer errors on both the mid-experimental (t=6.25, p<.0005)**and the postexperimental (t=5.99, p<.0005)**measures of general game skills. Within-group comparisons of the pre- and post-experimental measures of general game skills were consistent with these between-group findings: the Ss in the Experimental Group made significantly fewer errors on the postexperimental measure (t=6.32, p<.0003)**while those in the Control Group showed no reduction in their error scores. The results of the pre-experimental, midexperimental, and postexperimental comparisons of the general game skills of the two groups are shown in Tables 4, 5, and 6 respectively.

*two-tail test
**One-tail test

TABLE I

COMPARISONS OF THE PRE-EXPERIMENTAL NUMBER KNOWLEDGE TEST SCORES AND THE SPONTANEOUS QUANTITATIVE VOCABULARY SCORES

Scores		Experimental (n=20)		Control (n=20)	t*	P
Total Number Knowledge Test Score	M SD	87.10 35.45	M SD	90.30 37.34	1.94	.07
1. Counting-rote and rational	M SD	36.85 21.19	M SD	39.20 20.13	1.28	n.s.
2. Quantitative terms	M SD	33.20 7.11	M SD	32.35 8.67	0.86	n.s.
3. Knowledge of time	M SD	4.65 3.31	M SD	5.15 3.96	0.50	n.s.
4. Knowledge of money	M SD	5.55 3.72	M SD	5.65 4.23	0.10	n.s.
5. Shape identification	M SD	2.55 1.82	M SD	5.15 2.97	4.90	.001
6. Color recognition	M SD	4.30 1.78	M SD	2.95 1.39	3.38	.003
Spontaneous Quantitative Vocabulary Score	M SD	30.10 22.47	M SD	27.15 18.85	0.47	n.s.

*Two-tail tests

TABLE 2

COMPARISONS OF THE MIDEXPERIMENTAL NUMBER KNOWLEDGE TEST SCORES AND THE SPONTANEOUS QUANTITATIVE VOCABULARY SCORES

Scores		Experimental (n=20)		Control (n=20)	t*	p
Total Number Knowledge Test Score	M	30.40	M	25.90	3.46	.003
	SD	9.81	SD	10.84		
1. Counting-rote and rational	M	15.10	M	14.60	0.52	n.s.
	SD	7.44	SD	7.21		
2. Quantitative terms	M	6.80	M	5.25	2.26	.03
	SD	1.73	SD	1.67		
3. Knowledge of time	M	1.70	M	1.10	1.28	n.s.
	SD	1.81	SD	1.58		
4. Knowledge of money	M	2.70	M	2.10	2.45	.02
	SD	0.57	SD	1.07		
5. Shape identification	M	1.25	M	1.05	0.72	n.s.
	SD	0.85	SD	0.94		
6. Color recognition	M	2.85	M	1.80	6.84	.0001
	SD	0.36	SD	0.76		
Spontaneous Quantitative Vocabulary Score	M	4.65	M	3.45	0.93	n.s.
	SD	4.39	SD	3.12		

** Two-tail tests

TABLE 3

COMPARISONS OF THE POSTEXPERIMENTAL NUMBER KNOWLEDGE TEST SCORES AND THE SPONTANEOUS QUANTITATIVE VOCABULARY SCORES

Scores		Experimental (n=20)		Control (n=20)	t*	p
Total Number Knowledge Test Score	M SD	134.80 18.17	M SD	102.10 39.07	5.49	.0003
1. Counting-rote and rational	M SD	54.60 11.25	M SD	44.95 19.43	3.34	.003
2. Quantitative terms	M SD	42.05 2.11	M SD	31.65 9.23	5.35	.0003
3. Knowledge of time	M SD	8.75 3.65	M SD	6.85 4.55	2.31	.03
4. Knowledge of money	M SD	13.80 2.96	M SD	8.30 6.13	4.33	.0005
5. Shape identification	M SD	7.30 1.03	M SD	3.60 1.78	11.98	.0001
6. Color recognition	M SD	8.30 1.45	M SD	6.75 2.55	2.32	.03
Spontaneous Quantitative Vocabulary Score	M SD	54.65 29.52	M SD	29.35 19.24	3.58	.002

* One-tail test

TABLE 4

A COMPARISON OF THE PRE-EXPERIMENTAL GENERAL GAME SKILL ERROR SCORES

		Experimental (n=20)	Control (n=20)	t*	p
A. Explaining game	M	7.05	6.55	0.22	n.s.
	SD	7.38	8.17		
B. Plays in turn	M	23.50	30.25	2.63	.01
	SD	7.35	12.27		
C. Between turns	M	11.65	11.10	0.22	n.s.
	SD	10.39	11.18		
D. Takes one turn	M	11.70	14.05	0.93	n.s.
	SD	8.85	11.16		
E. Touching game	M	7.65	6.60	0.41	n.s.
	SD	10.92	6.41		
F. Follows rules	M	34.40	39.10	1.74	n.s.
	SD	9.87	13.84		
G. Losing	M	2.95	1.40	1.12	n.s.
	SD	5.25	2.64		
H. Decisions	M	1.65	3.80	1.62	n.s.
	SD	2.13	5.88		
I. Handles game	M	7.65	5.15	1.04	n.s.
	SD	8.94	6.78		
J. Game over	M	1.75	0	2.88	.009
	SD	2.71	0		
Total Score A->J	M	109.95	118.00	0.68	n.s.
	SD	51.85	59.21		

*Two-tail tests

TABLE 5

A COMPARISON OF THE MIDEXPERIMENTAL GENERAL GAME SKILL ERROR SCORES

		Experimental (n=20)	Control (n=20)	t*	p
A. Explaining game	M	0.20	0.70	2.51	.02
	SD	0.41	1.13		
B. Plays in turn	M	2.50	4.80	3.54	.002
	SD	1.91	2.87		
C. Between turns	M	1.35	3.55	3.29	.004
	SD	1.38	2.30		
D. Takes one turn	M	0.10	0.55	1.05	n.s.
	SD	0.44	1.82		
E. Touching game	M	0.95	2.25	1.71	n.s.
	SD	1.46	3.12		
F. Follows rules	M	4.85	10.30	5.35	.0005
	SD	1.13	4.14		
G. Losing	M	0.05	0.10	0.43	n.s.
	SD	0.22	0.44		
H. Decisions	M	0.15	0.05	1.00	n.s.
	SD	0.36	0.22		
I. Handles game	M	0.75	0.55	0.51	n.s.
	SD	1.16	1.27		
J. Game over	M	0.10	0	1.00	n.s.
	SD	0.44	0		
Total Score A->J	M	11.00	22.85	6.25	.0005
	SD	4.28	7.95		

*Two-tail tests

TABLE 6

A COMPARISON OF THE POSTEXPERIMENTAL GENERAL GAME SKILL ERROR SCORES

		Experimental (n=20)	Control (n=20)	t*	p
A. Explaining game	M	2.35	6.90	2.85	.005
	SD	2.49	6.68		
B. Plays in turn	M	9.90	26.35	5.08	.0003
	SD	4.32	14.51		
C. Between turns	M	5.40	16.30	6.10	.0003
	SD	4.01	7.67		
D. Takes one turn	M	4.05	11.25	2.64	.008
	SD	4.01	12.69		
E. Touching game	M	4.20	9.10	2.19	.02
	SD	5.31	7.77		
F. Follows rules	M	17.20	41.00	8.35	.0001
	SD	7.18	12.17		
G. Losing	M	2.10	3.00	0.66	n.s.
	SD	3.33	5.40		
H. Decisions	M	1.60	3.10	1.13	n.s.
	SD	2.21	5.50		
I. Handles game	M	4.95	5.20	0.13	n.s.
	SD	4.39	6.76		
J. Game over	M	0.55	0.35	0.13	n.s.
	SD	1.23	0.81		
Total Score A -> J	M	52.25	122.55	5.98	.0003
	SD	22.28	56.34		

* One-tail tests

It was hypothesized that as a result of participation in the game training program there would be an increase in the Experimental Group Ss' stated preferences for social rather than solitary play. The hypothesis was not tested because the pre-experimental measures used (situational tests, doll play, and picture stories) proved to be unreliable due to the qualifications which the older Ss attached to their initial choices and to the fluctuations in the choices of the younger Ss. However, the situational tests did yield information concerning the retarded child's attitudes towards social play. The Ss differentiated between the school setting and the home in stating their preferences for social or solitary play with an attractive toy. Almost all of the Ss (n=37) exhibited a considerable amount of ambivalence concerning social play in the school setting. Older Ss (n=21) preferred social play if they could be the undisputed controllers of the toy resources. Younger Ss (n=16) showed marked approach-avoidance conflict as they stated that they preferred social play "if he (the chosen playmate) plays nice", and in the next sentence reversed their preference to solitary play. In the home setting the majority of the Ss(n=37) stated an unqualified preference for solitary play. Further questioning revealed that these Ss were certain that other children would take the toys and become the controllers of the toy resources.

The last hypothesis stated that the Experimental Group Ss would engage in more voluntary social participation in the school setting as a result of their participation in the game training program. The pre-experimental measures showed a high incidence of voluntary social participation among Ss (n=28) who had been enrolled in the special classes for more than two months. The Ss (n=12) who were new to the special classes showed a low rate of voluntary social participation on the pre-experimental measures but, by the end of six weeks, exhibited a high rate of social participation. In view of the high incidence of voluntary social participation within the retarded classes no further measures of this variable were obtained.

The major findings of this study can be summarized as follows:

1. Knowledge of number: The Experimental Group Ss scored higher than did the Control Group Ss on both the midexperimental ($p < .003$) and the postexperimental ($p < .0003$) measures.

2. Spontaneous use of quantitative terms: The scores of the Experimental Group were higher than those of the Control Group on the postexperimental measure ($p < .002$).

3. General game skills: The Experimental Group Ss made fewer errors than did the Control Group Ss on both the midexperimental ($p < .0005$) tests and the postexperimental ($p < .0005$) tests.

DISCUSSION

The results of this study showed clearly that the game training program was effective in both its major goals. The Ss in the Experimental Group improved markedly in knowledge of number and in general game skills, whereas the Ss in the Control Group showed less improvement in knowledge of number and no improvement in general game skills. It was expected that the Control Group Ss would show some improvement in knowledge of number since their arithmetic program included the direct teaching of most of the tasks on the Number Knowledge Tests.

There was evidence, also, that the game training program was effective in improving the Experimental Group Ss' ability to respond consistently, this ability being regarded by elicitation theorists (17) as essential if the retarded child is to reach his potential on learning tasks. First, the maximum game time increased from less than two minutes at the beginning of the program to 12 minutes or longer at the end of it. No such change occurred in the Control Group: in the postexperimental measures these Ss were unable to attend to the game for any length of time without a significant lapse of attention. Second, the amount of adult supervision needed dropped sharply. At the beginning of the game training program constant adult supervision was needed to enforce any rule. By the end of the program the adult could withdraw from actively supervising play because rule-breakers were reprimanded by the other players who attended closely to other players' turns as well as to their own. Third, the number of sessions for the administration of the Number Knowledge Test - Form A decreased from three or more for both the Experimental and the Control Groups in the pre-experimental administration to one session for 14 Ss in the Experimental Group as compared to one session for only four Ss in the Control Group ($X^2=10.01$, $df=1$, $p<.01$).

The role of models in the socialization of young children has received considerable emphasis in recent laboratory investigations, a general finding being that punishment of the model greatly reduces the frequency with which young normal or retarded observers subsequently exhibit the same response (2, 34). This finding is consistent with that of the present study: in any one session the Ss rarely made the errors that had resulted in verbal reprimand for the adult model. Errors for which the adult model was reprimanded over several sessions gradually dropped out of the response repertoire of the Ss in the game situation.

There was evidence that the Ss who participated in the game training program had begun to develop quantitative thinking ability. Their spontaneous use of quantitative terms in the experimental setting showed a marked increase; unsolicited reports from teachers and parents concerning 16 of the 20 Experimental Group Ss provided the information that for the first time these Ss were using quantitative terms freely in both the classroom and in their free play at home and at school.

The retarded child typically adjusts well to the peer group in the special classroom but is far less effective in interaction with his normal chronological peers (19, 24, 26). Further, in contrast with the normal child, the retarded child lacks the response repertoire for competent handling of common social interactions (35). The game training program was effective in increasing the Ss' opportunities for social participation by teaching the skills that facilitated their entry into groups that had previously been closed to them. By the end of the fifth month of the program, 14 of the Experimental Group Ss were playing games at home routinely with their normal siblings and neighborhood peers. The effect of the novel experience of having other normal children play with them on the self-esteem of the retarded child can be inferred from the following verbatim comments:

"We played _Star Lady_ and my mommy said I was a real good player and Bonnie (sister) didn't know how to play and I winned a lot and that was good because Bonnie always says I can't play with her because I don't play good."

"We all played _Whistle Stop_ with my whistle and I had to be leader because no other kids know how to play _Whistle Stop_, they never played with me before."

CONCLUSIONS AND RECOMMENDATIONS

The following conclusions are drawn from this study:

1. Small group games can be used to teach basic number concepts to young, educable, mentally retarded children. The important feature of the game program used in this study was an emphasis on the intentional teaching of general game skills with the manipulation of numbers being an integral part of the game activity but incidental to the intentional teaching of game skills. Children who participated in the nine-month game program showed marked improvement in knowledge of number and general game skills.

2. Retarded children exhibit a high level of voluntary social participation in the special class school setting but observational data showed that their inability to handle simple social situations causes them some difficulty in the school and great difficulty in the home setting. These two findings are consistent with the results of other studies (19, 24, 26) of the social adjustment of retarded children.

3. The games used in this study were identical to, or modified versions of, those played by normal children of the same chronological age as the retarded children. Many parents and teachers were surprised that the retarded children were able to play these games. Their reaction was typical (29): many adults underestimate the complexity of tasks that the retarded child can learn and thus deprive him of important learning experiences.

The following recommendations are related to the experimental procedures:

1. Game procedures should be a regular part of the school curriculum for retarded children. The retarded child seldom has a success experience in games with his normal peers and his retarded peers are usually unable to play games. The results of the present study show clearly that small group games are well within the capabilities of the retarded child and that this child could acquire both social competence and academic knowledge through this medium.

2. Modeling procedures should be used as a teaching technique for retarded children. The procedure of having the adult model make mistakes in order to emphasize the general game skills proved to be an extremely effective teaching technique. It caused the children to focus on the adult model's behaviors and to verbalize her errors. Since there are often two adults in special classrooms, it should be possible to use this modeling procedure as a teaching technique.

3. Attention-directing variables should be used more often in the special classroom. In the present study excitement in the game situation, rewards, and modeling procedures were successfully used to focus the children's attention on the game procedures. In the special classrooms that we see regularly, attention-directing variables are seldom used.

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APPENDIX A

Number Knowledge Test - Form A

Picture Items - Form A

Number Knowledge Test - Form B

Picture Items - Form B

Notes re Number Knowledge Tests - Subscore Reliability

Test Administration Procedures

Scoring - Form A and Form B

NUMBER KNOWLEDGE TEST - FORM A

Name_______________________ C.A.____ I.Q.___ Date______

Group: Exp.Cont. Tester________________ School____________

Comments:

1. Ability to Count

a. Rational 1st trial_________ 2nd trial_____

b. Rote 1st trial_________ 2nd trial_____

2. One to One Correspondence

a. Two ____ b. Four____ c. One___ d. Three____

e. Four ___ f. One ____ g. Three__ b. Two _____

3. Specific Quantitative Terms

a. big* _____
b. more* _____
c. smallest _____
d. first _____
e. little _____
f. penny _____
g. nest _____
h. long* _____
i. shortest _____
j. top _____
k. second _____
l. short* _____
m. nickel _____
n. under* _____
o. highest _____
p. over _____
q. count _____
r. left* _____
s. longest _____
t. bottom _____
u. third _____
v. up* _____
w. right _____
x. lower _____
y. days of week ____
z. all together ____
aa. biggest ____
bb. down ____
cc. dime ____
dd. enough for each*____
ee. the same as ____
ff. lowest ____
gg. how many ____
hh. longest ____
ii. higher* ____
jj. as many as* ____

4. Specific Number concepts

a. one hand ___ b. three cars* ___ c. four claps ___
d. three fingers*___ e. five checkers*___ f. one clap ___
g. two feet* ___ h. one penny ___ i. five knocks ___
j. five fingers* ___ k. four dolls* ___ l. two whistles___
m. four feet* ___ n. two blocks* ___ o. three tones ___
p. two blocks* ___ q. four cars* ___ r. one turtle ___
s. five checkers*___ t. three dolls* ___ ___

5. Money

a. money___b. penny___c. nickel___d. dime___e. quarter___
f. fifty___g. dollar bill___h. penny-nickel*___i. nickel-dime*___
j. quarter-dime*___k. dollar-fifty*___l. quarter-fifty*___
m. 4 pennies-nickel*___n. 3 nickels-dime*___o. 2 dimes-quarter*___

6. Money: Show how many pennies in a nickel ___
nickels in a dime ___
nickels in a quarter___
nickels and dimes in a quarter___

7. Time-Calendar

a. identifies clock ___ b. watch___ c. calendar___
d. use of clock ___ e. watch___ f. calendar___

8. Time: 3:00 ___ 9:30 ___ 7:00 ___ 2:15 ___
10:00 ___ 5:45 ___ 12:20 ___ 11:40 ___
6:00 ___ 8:10 ___ 1:00 ___ 9:00 ___
4:05 ___ 10:15 ___ Total correct ______

9. Shapes: Identify a star _____ square _____

oval _____ rectangle _____

circle _____ triangle _____

diamond _____ heart _____

10. Colors: Red _____ Blue _____ Yellow _____

White _____ Black _____ Grey _____

Orange _____ Purple _____ Green _____

11. Spontaneous Quantitative Vocabulary:

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

Picture Items - Number Knowledge Test - Form A.

1. Three trains on parallel tracks. The trains differ in size, color, type of car, and number of passengers.

2. Two boys holding balloons. The boys differ in size and in appearance. Their balloons differ in size and color.

3. Two mothers and their daughters on a flight of stairs. The two daughters are each carrying plates, one is full the other is empty.

4. A mother is giving out food to a line of children and to a dog. The children differ in size and in appearance. They are all holding plates.

5. A mother and two children are walking over a bridge. Two boats are passing under the bridge, four planes are flying overhead.

6. A boy is drawing circles and squares on a chalkboard in a room that looks like a classroom.

7. A rural scene with fir trees and apple trees. There are some fir trees and some apples on the ground.

8. A man and a boy in a clock and calendar store. The man is behind the counter.

9. A big boy and a small boy each holding balloons with real coins glued to the balloons.

10. A busy city street with a variety of motor vehicles and houses and apartments. A plane is flying overhead.

NUMBER KNOWLEDGE TEST - FORM B

Name ______________________ C.A.____ I.Q.____ Date ____

Group: Exp. Cont.Tester______________ School______________

Comments:

1. Ability to Count - Rational______________Rote.____________

2. One to One Correspondence - Two___________

3. Specific Quantitative Terms

   a. top ___ b. second___ c. over___ d. right___

   e. second ___ f. top ___ g. right___ h. over ___

4. Specific Number Concepts

   a. five fingers ____ b. one hand ____ c. three knocks____

5. Money

   a. penny ______ b. nickel ______ c. dime ______

6. Time

   a. 7 o'clock ___ 4 o'clock ___ 10 o'clock ___ 12 o'clock___

7. Quantitative Pictures

   1.

   2.

8. Shapes

   a. rectangle _______ b. diamond _______ c. circle _______

9. Colors

   a. blue _____ b. green ____ c. grey ____

Picture Items - Number Knowledge Test - Form B.

1. Four otters are sliding down an icy bank into the water while a rabbit watches.

2. A mother bear is watching three baby bears. One bear is climbing a tree, one is falling down the tree, and the third bear is watching the others.

Notes re Number Knowledge Test - Forms A and B

1. The Number Knowledge Test yielded the following subscores:

   (a) counting - included rote and rational counting.
   (b) Quantitative - included one-to-one correspondence, specific quantitative terms and number concepts.
   (c) Money - included coin identification and knowledge of relative and absolute value of coins.
   (d) Time - included identification of time instruments and ability to tell time.
   (e) Shape - identification of shapes.
   (f) Color - identification of colors.
   (g) Spontaneous Quantitative Vocabulary - spontaneous use of quantitative terms.

2. Reliability of subscores: Counting .99; Quantitative .96; Money .91; Time .94; Shape .84; Color .92; Spontaneous Quantitative Vocabulary .81.

3. One-to-One Correspondence - No S (n=40) had any difficulty with these items on the pre-experimental test, most of the scores on this item were perfect or nearly perfect.

4. Picture Items - The pictures were in clear, attractive colors on light backgrounds. The pictures in Form A were seven by nine inches and those in Form B were four by five inches.

5. Number Recognition - This skill was not included in the group of number skills used in the game training program because we felt that workbook activities are particularly important in learning to recognize numbers. A teacher who wishes to use games to supplement number recognition activities could easily modify many of the games that we used. The players should sit in a row rather than around a table because it is important to avoid showing the numbers upside down until the player is fairly proficient at number recognition.

Administration of Number Knowledge Test - Form A.

I. Ability to Count

1a. rational counting MATERIALS - 20 red checkers, 2 cards. Spread checkers on left card, leave right card empty. No overlapping of checkers or cards.

"Can you count"? PAUSE. If child says "yes", go right on. "I want you to count these checkers for me. You can move them over to this paper here as you count them, like this". Demonstrate. "Now you count them nice and loud". If child does not count, move one over saying, "One", as you do so. If child says he can't count, encourage him and use prompting sentence above. See scoring note following 1b re use of this prompting sentence.

1b. rote counting NO MATERIALS ON TABLE

"I'd like to hear you count as far as you can go". If child hesitates give him a few seconds only. Do not allow a long uneasy silence.* Say, "Count for me. One-".

* In scoring this item do not credit child with one point for "one", if this was all he said after you had used prompting sentence.

1a. rational counting - second trial MATERIALS - 20 black checkers, 2 cards. Spread checkers out on left card.

"Now I want you to count my black checkers. Put them over here as you count them, like this". Demonstrate.

1b. rote counting - second trial NO MATERIALS ON TABLE

"Now I want you to count as far as you can go. Count for me just the way you did last time".

II. One-to-One Correspondence

2a. Two - MATERIALS - 2 girl dolls, 2 baby baths, 2 cards. Put 2 girls on one card side by side, 2 baths on the other card on your right.

"These girls (point to girls) are going to give their baby dolls a bath. Give each girl a bathtub so she can give her doll a bath".

2b. Four - MATERIALS - 4 girl dolls, 4 cups, 3 cards. Use 2 cards overlapping slightly so that the 4 dolls will be in a row rather than a semi-circle. 4 cups on left cards, 4 dolls on right cards.

"These girls (point to girls) want some milk. Give each girl a cup of milk".

2c. One - MATERIALS - 1 girl doll, 1 blue mirror, 2 cards. Put mirror on left card, doll on right card.

"This girl (point to girl) wants to look at herself in a mirror. Give her a mirror".

2d. Three - MATERIALS - 3 girl dolls, 3 baby bottles, 2 cards. Put 3 dolls on right card, 3 bottles on left card.

"These girls are going to wash their dolls' bottles. Give each girl a bottle to wash".

2e. Four - MATERIALS - 4 boy dolls, 4 yellow cars, 4 cards. Put 4 boys on overlapping right cards, 4 cars on left card.

"These boys (point to boys) want cars to play with. Give each boy a car to play with".

2f. One - MATERIALS - 1 boy doll, 1 turtle, 2 cards. Put boy on right card, turtle on left card.

"This boy wants a turtle to play with. Give the boy a turtle".

2g. Three - MATERIALS - 3 boy dolls, 3 brooms, 2 cards. Put boys on right card, brooms on left card.

"These boys are going to sweep the floor. Give each boy a broom so he can sweep the floor".

2h. Two - MATERIALS - 2 boy dolls, 2 seals. Put boys on left card, seals on right card.

"These boys (point to boys) want to take their seals to the beach. Give each boy a seal so that he can take it to the beach".

III. Specific Quantitative Terms

3a. big* - MATERIALS - 2 china cats, 2 cards. Put both cats on one card on your left. Place the bigger cat on the left side of the card.

"These are my cats. One cat is big, the other cat is not big. Put the big cat on this paper here". (Point to empty card.)

* Give items marked with asterisk again at the end of the section. Do not change the procedure in any way, simply repeat item. These items that are to be repeated occur in

Sections III, IV, and V only. See scoring note about items given twice.

3b. more* - MATERIALS - 9 black checkers, 2 cards. Put 7 checkers on one card in an uneven round area, not touching. Put 2 checkers on the other card on your left.

"Look - checkers" (touch big pile then small pile). "Are there more checkers here (touch big pile) or here? (touch small pile). Put your finger on the paper that has more checkers".

3c. smallest - MATERIALS - 3 china dogs, 2 cards. Put 3 dogs on card on your left with smallest dog in center.

"See my dogs. One dog is the smallest. Put the smallest dog on this paper here". (Point to card on your right.)

3d. first - MATERIALS - 4 boy dolls, 4 plates, 1 mother doll. Put 4 boys in a line with a plate in front of each, hold the mother doll facing the first boy in the line.

"See the boys. They are waiting in line for hamburgers. Here is the teacher with the hamburgers. Which boy gets his hamburger first? Put your finger on the boy who gets his hamburger first".

3e. little - MATERIALS - 1 big red car, 1 small red car, 2 cards. Put 2 cars on card to your left, put the smaller car to the left side of the card.

"See the cars. One car is big and one is little. Put the little car on this paper here". (Point to empty card on right.)

3f. penny - MATERIALS - 1 penny and 1 card. Put the penny on the card.

"What is this? What do we call this"?

If child says money say, "What kind of money? What's its name"?

3g. next - MATERIALS - 4 girl dolls and a mother doll. Put 4 girls in line, hold mother facing the first girl in line.

"See the girls. Their mother is going to give them each some candy. Who gets candy first? Put your finger on the girl who gets candy first".

3h. long* - MATERIALS - 2 blue pipe cleaners, one very long, one short, and 2 cards. Put the 2 sticks on a card to your left, put the shorter stick on the right, the longer on the left. Be sure that they are at right angles to the child.

"See these sticks. One is long and one is not so long. Put the long one on this paper here".

3i. shortest - MATERIALS - 3 mauve pipe cleaners, one quite short, one medium and one long and 2 white cards. Put the three sticks on the card to your left, put them at right angles to the child with the shortest on the extreme right, the longest in the middle.

"See these sticks. One is the shortest stick. Put the shortest stick on this paper here".

3j. top - MATERIALS - 4 orange blocks. Put the four blocks one on top of the other to form an irregular pile.

"See my blocks. See what I can make. Which block is the top one? Put your finger on the block that is the top one".

3k. second - MATERIALS - 4 girl dolls and a mother doll. Put 4 girl dolls in a line seated and mother doll facing line.

"See the girls. Their Mommy is bringing them colored paper. Which girl is second in line? Put your finger on the girl who will be the second one to get colored paper".

3l. short* - MATERIALS - 10 black checkers, 1 card. Put checkers in two parallel lines of 7 and 3 with the shorter line nearer the child.

"See my checkers. I'm putting them in a line here and a line here. Which line is the short line? Put your finger on the line that is short".

3m. nickel - MATERIALS - 1 nickel, 1 card. Put nickel on card.

"What is this? What do we call this'?

3n. under* - MATERIALS - 1 green square block, 1 red checker, 2 cards. Put block and checker on one card.

"Put this (touch red checker) under this (touch green block). Do it on this paper here". (Point to empty card.)

3o. highest - MATERIALS - 15 red checkers, 1 card. Build three towers on one card with 8, 5, and 2 checkers in them. Have the 8 on your left, the 2 in the center.

"See what I built. Which is the highest? Put your finger on the one that is the highest".

3p. over - MATERIALS - 1 big yellow rubber circle, 1 small red rubber circle, 2 cards. Put both circles on left card.

"Put this (touch yellow) over this (touch red). Do it on this paper here". (Point to empty card.)

3q. count - MATERIALS - 3 footballs, 1 card. Put all three balls on the card in a row.

"I want you to count these footballs".

3r. left* -MATERIALS - 1 card.

"Put your left hand on this paper. Show me which is your left hand".

3s. longest - MATERIALS - 3 red pipe cleaners, 1 card. Put cleaners on card with the longest in middle, shortest on the left, all pointing to child.

"See my red sticks. Which is the longest stick? Put your finger on the longest stick".

3t. bottom - MATERIALS - 4 blue blocks, 1 card. Put blocks in an irregular pile on the card.

"See what I made with my blocks. Which is the bottom block? Put your finger on the bottom block".

3u. third - MATERIALS - 4 boy dolls in a line, 1 card, 1 football.

"See the boys. They are going to take turns kicking the ball. Who will be first? (Identify first)- Who will be third? Put your finger on the boy who is third in line".

3v. up* - MATERIALS - 1 orange ball.

"See the ball. Throw it up for me. (Hand ball to child.) If in doubt ask child "Which way is up"?

3w. right*- MATERIALS - 1 blue rubber circle, 1 card. Put circle on card.

"Put your right hand over this so I can't see it."

3x. lower - MATERIALS - 11 black checkers, 1 card. Put the checkers on card in piles of 7 checkers on right, 4 on left.

"See what I made. One pile is lower than the other. Which pile is lower? Put your finger on the pile that is lower".

3y. days of week - MATERIALS - none.

"What day is it today"? If child does not answer, tell him. "Can you say the days of the week"?

3z. all together - MATERIALS - 6 footballs, 3 cards. Put 4 balls on 1 card, 2 on the other card, leave 1 card empty in the center.

"See these footballs. Put them all together on this paper here". (Point to empty center card.)

3aa. biggest - MATERIALS - 3 blue rubber circles which are small, medium and large. Put them on the table with large circle in center.

"See my blue pieces. Which is the biggest? Put your finger on the biggest one".

3bb. down - MATERIAL - 1 orange ball.

"Which way is down"? Identify whether child knows by asking him to point with his finger. "Here is a ball, throw the ball down".

3cc. dime - MATERIALS - 1 dime, 1 card. Put the dime on card.

"What is this? What do we call this"?

3dd. enough for each* - MATERIALS - 4 boy dolls, 3 small silver clocks, 1 card. Put the four boys in a row, put the three clocks in a row on the card.

"See the clocks. All the boys want one. Are there enough for each boy to have one"?

3ee. the same as - MATERIALS - 3 black, 3 yellow, and 2 white sheep. 2 cards. Put all the sheep on one card except one white one. Hold this white one in your hand.

"See the sheep. All these animals are sheep (sweeping gesture). See this sheep, I'll put him here (put on empty card). Find one just the same as this one and put it here". (point to card)

3ff. lowest - MATERIALS - 16 red checkers, 1 card. Make 3 piles, 8 in center, 5 on right.

"See what I made. Which pile is the lowest? Put your finger on the lowest. Put your finger on the lowest pile".

3gg. how many - MATERIALS - 2 drums, 1 card. Put drums on card.

"See the drums. How many drums are there? Tell me how many drums there are".

3hh. largest - MATERIALS - 3 blue rubber circles, small, medium and large. Put in a row with the large on right, small in the middle, medium on left.

"See my blue circles. Which is the largest? Put your finger on the largest one".

3ii. higher* - MATERIALS - 10 red checkers, 1 card. Make 2 piles, 7 on left, 3 on right.

"See what I made. Which one is higher? Put your finger on the one that is higher".

3jj. as many as* - MATERIALS - 5 footballs, 2 cards. Put three footballs on the left card, two on the right.

"See all the footballs. Are there as many here as there are here? Is this (point to right) as many as this (point to left)"?

IV. Specific Number Concepts

4a. one hand - NO MATERIALS.

Hold up one hand at about eye level. Say "How many hands is this"? Keep your other hand out of sight.

4b. three cars* - MATERIALS - 3 yellow cars, 1 card. Put cars in a row on the card.

"How many cars are there here"? PAUSE, IF NO ANSWER SAY "See my cars. How many cars do I have here"?

4c. four claps - NO MATERIALS.

Say "Listen. I'm going to clap my hands. Tell me how many times I clap".

Now, clap four evenly-spaced, decisive claps.

Say "How many times did I clap"?

4d. three fingers* - NO MATERIALS.

Hold up three fingers. Keep other hand down, keep thumb and forefinger well down.

Say, "How many fingers can you see"?

4e. five checkers* - MATERIALS - 5 red checkers, 1 card. Put checkers in a row on the card.

"How many checkers are there here"?

Note: Put checkers on quickly, do not give child the chance to count as you put each one on.

4f. one clap - NO MATERIALS.

Say "Listen. I'm going to clap my hands. Tell me how many times I clap".

Now clap once and put hands down.

Say, "How many times did I clap"?

4g. two feet* - MATERIALS - 1 boy doll, 1 card. Stand boy on card facing child.

Say "Here is Tommy, Look at Tommy. How many feet has Tommy got"?

4h. one penny - MATERIALS - one penny, 1 card. Put penny on card.

Say "How many pennies are there on this paper"?

4i. five knocks - NO MATERIALS.

Say, "Listen. I'm pretending I'm knocking at your door. Tell me how many times I knock".

Now knock 5 times, evenly-spaced, decisive.

"How many knocks was that"?

4j. five fingers* - NO MATERIALS.

Hold up one hand with fingers spread at child's eye level. Keep other hand out of sight.

"How many fingers have I on this hand? How many fingers can you see"?

4k. four dolls* - MATERIALS - 4 boy dolls in a row on table in front of child.

"How many boys are there here"?

4l. two whistles - MATERIALS - one toy whistle.

"Listen to me blow my whistle." Now blow 2 short decisive spaced blows.

"How many times did I blow the whistle"?

4m. four feet* - MATERIALS - one dog, 1 card. Put dog on card.

"See my dog. How many feet has he got"? Now, hand dog to child. PAUSE. "How many feet has this dog got"?

4n. two blocks* - MATERIALS - 2 green blocks, 1 card. Put blocks side by side on card.

"See my blocks. How many blocks are there here"? Point to blocks.

4o. three tones - MATERIALS - 1 harmonica.

"Look. See my harmonica. Listen. Tell me how many times I blow it".

Now blow three evenly-spaced, short blows.

"How many times did I blow on it"?

4p. two blocks* - MATERIALS - 2 blue blocks, 1 card. Put blocks parallel on card.

"See my blocks. How many blocks are there here"? Point to blocks.

4q. four cars* - MATERIALS - 4 red cars, 1 card. Put cars on card.

"See my cars. How many cars are there here"? (Point to paper.)

4r. one turtle - MATERIALS - one turtle, 1 card. Put turtle on card.

"How many turtles are there here"?

4s. five checkers* - MATERIALS - 5 black checkers in domino pattern on card.

"How many checkers do you see here"?

4t. three dolls* - MATERIALS - 3 boy dolls on table in a row.

"Look, here are some boys. How many boys are there here"?

V. Money

5a. identifies as money - MATERIALS - two each of penny, nickel, dime, quarter, fifty cent piece, and dollar bill. Put all money on one card. Wave hand over the whole group.

"See all these things. What is all this? What do we call it"? If child identifies one coin say, "What do we call all this"?

5b - 5g. identifying particular coins and dollar bill - MATERIALS - same as 5a. Keep all money out of sight except the one piece needed for question. Put coins/bills on a card one at a time.

"What is this? (point to coin.) What do we call this"?

5h* - 5o* relative value of coins - MATERIALS - same as 5a. Keep all money out of sight except coins needed. Put pairs or sets out well separated on card with alternate placement of higher value coins and alternate pointing.

"Could you buy more candy with this (point to one) money or with this money (point to other)? Put your finger on the money that would buy you more candy". Note that each of these items should be given twice.

VI. Money

6a. MATERIALS - 10 pennies, 10 nickels, 10 dimes, 2 cards. Spread out all relevant coins on the left card, leave right card empty.

"See all these pennies, I want enough pennies to make a nickel. Show me how many pennies make a nickel. You can put them over here". (Point to empty card.) Follow the same procedure for each of the other three items.

VII. Time - Calendar

7a. clock - MATERIALS - one small clock and a card. Put the clock on the card and point to it.

"What is this? What do we call this"?

7b. watch - MATERIALS - one toy wrist watch and a card. Procedure same as 7a.

7c. calendar - MATERIALS - one small calendar. Procedure same as 7a.

7d. use of clock - MATERIALS - same as 7a. Hold up the clock.

"What do we use this for? or What do we do with this"?

7e. use of watch - MATERIALS - same as 7b. Procedure same as 7d.

7f. use of calendar - MATERIALS - same as 7c. Procedure same as 7d.

VIII. Time

MATERIALS - a set of 14 play clocks each set at the times on the test.

"Can you tell time? I'll show you a clock and you see if you can tell me what time it says". Now show the child the clocks one at a time. If he fails the first three items (3:00, 10:00, 6:00) do not give any more.

IX. Shapes

MATERIALS - small wooden star, oval, circle, diamond, square, rectangle, triangle, heart. A card. Put out one shape at a time.

"What do we call this? What do we call things that are this shape"?

X. Colors

MATERIALS - Nine circles on white cards. Each circle is a different color - red, white, orange, blue, black, purple, yellow, grey, green. Point to the color.

"What do we call things that are this color? If you had a balloon this color what would you call it"?

XI. Spontaneous Quantitative Vocabulary

MATERIALS - 2 practice pictures, 10 test pictures. Keep all pictures out of sight except the one you are using.

Practice Pictures - "See this picture. Tell me a story about it. Tell me what is happening in this picture". Give lots of encouragement. Help the child. Do not record the stories.

Test Pictures - "You tell good stories. I have some more pictures. I will show you a picture and you tell me a story about it. Here is the first picture, tell me a story about this picture. I will write down your stories". Same procedure for all ten pictures. Be appreciative and encouraging but avoid giving any cues.

Administration of Number Knowledge Test - Form B

MATERIALS - Same as those used in administration of Form A for items 1a, 1b, 2a, 3j, 3k, 3p, 3w, 4a, 4j, 4i, 5b, 5c, 5d, 8, 9. Quantitative pictures are different from those used on Form A. Procedures are all the same as those used in Form A.

Scoring - Form A and Form B

I. Ability to Count

1a. rational counting - up to 5 give one point for each number counted; for 6 or 7 give one point; for 8 or 9 give one point; for 10 give one point; for 11 or 12 give one point each; for 13 give one point, for 14 or 15 give one point; for 16, 17 or 18 give one point; for 19 give one point; for 20 give one point. Total possible points on each Rational Counting Trial = 15 points.

1b. Same, except total should be halved. Total possible points on each Rote Counting Trial = 7-1/2 points. Total possible points* on section = 45 points.

* Follow same procedure for Form B on this and each of the following items.

II. One-to-One Correspondence

Give one point for each item answered correctly. Total possible points on section = 8 points.

III. Specific Quantitative Terms

The following items must be given twice: 3a, 3b, 3h, 3l, 3w, 3n, 3r, 3v, 3dd, 3ii, 3jj. A subject could get the answer by guessing, there are only two alternatives. Give one point for each item that he answers correctly both times; give one point for every other item answered correctly. Total possible points on section = 36 points.

IV. Specific Number Concepts

The following items must be given twice: 4b, 4d, 4e, 4g, 4j, 4k, 4m, 4n, 4q, 4s, 4t. Give one point for each item that he answers correctly both times; give one point for every other item answered correctly. Total possible points on section = 20 points.

V. Money

All two-coin combinations (5h - 5o) must be given twice. Same scoring as in IV. Total possible points on section = 15.

VI. Money

This section is given only if child could identify coins in V. One point for each. Total possible points on section = 4.

VII. Time - Calendar

One point for each item. Total possible points for section = 6.

VIII. Time

One point for each item. Total possible points = 14.

IX. Shapes

One point for each. Total possible points = 8.

X. Colors

One point for each. Total possible points = 9.

XI. Spontaneous Quantitative Vocabulary

One point for each quantitative word used. Note: We were not concerned with the accuracy of the words used. To score for accuracy the S would have had to point to parts of the picture as he talked. This procedure would have markedly reduced the amount of verbalization that occurred.

APPENDIX B

General Game Skills Rating Form

Definitions of General Game Skills

Experimental Test Games

GENERAL GAME SKILLS

Name ______________________ Date ___________ Rater _____________

A. Explaining game

3 - listens - quietly

2 - restless

1 - withdraws - disrupts

B. Plays in turn

3 - with minimum help

2 - help several times

1 - constant help

C. Between turns

3 - attends

2 - attention wanders

1 - withdraws - disrupts

D. Takes one turn

3 - frequently

2 - several lapses

1 - almost never

E. Touching game

3 - almost never touches

2 - several times

1 - constantly touching

F. Follows rules

3 - with minimum help

2 - help several times

1 - constant help

G. Losing

3 - accepts - good loser

2 - accepts - reluctantly

1 - withdraws - disrupts

H. Decisions

3 - accepts at once

2 - accepts - reluctantly

1 - withdraws - disrupts

I. Handles game

3 - carefully

2 - some roughness

1 - always rough

J. Game over

3 - accepts at once

2 - accepts - reluctantly

1 - withdraws - disrupts

General Game Skills - Definitions

A. Explaining game - refers to the way the child behaves during the pre-game period and during the five-minute practice game period while the game controller is explaining rules and demonstrating procedures. Score an error here if the child is restless, disruptive or inattentive. We will infer that the child is not attending if he becomes absorbed in handling his clothes, looking around the room, if he leaves the table without a good reason, talks to the other children about irrelevant matters, or wants to stop playing.

B. Plays in turn - refers to the child's ability to take his turn promptly. Score an error here whenever the child has to be reminded to take his turn and also if he plays out of turn.

C. Between turns - refers to the way the child behaves when it is not his turn to play. Score an error here if the child fails to attend to the game when it is not his turn.

D. Takes one turn - refers to the way the child behaves when it is his turn to play. Score an error if he takes more than one turn at this time.

E. Touching game - refers to the child's handling game when the pieces are being set out by the game controller or another player, or to his handling pieces that he should not touch during the game at all, e.g., other players' cards, or to his handling the game or center pack of cards when it is not his turn. Score an error here for any of the above.

F. Follows rules - refers to the child's ability to follow rules specific to the game being played. The behaviors that fall in B, D, and E occur in almost all games and should not be scored under F. Score an error here if the child breaks a specific rule.

G. Losing - refers to the child's reaction to losing while the game is still going on or after the game is finished. Score an error here if the child is a poor loser, e.g., sulks, cries, complains, refuses to play anymore, etc.

H. Decisions - refers to the child's willingness to accept game controller's decisions about arguments, rules, seating plans, choice of game, etc. Score an error here if child refuses to abide by controller's decision or if he shows extreme reluctance.

I. Handles game - refers to the care with which the child handles the game materials. It is important to make allowance for accidents and clumsiness. Score an error here if the child appears to deliberately tear, drop, bend, break or throw game pieces.

J. Game over - refers to the child's willingness to accept that the game is over. Score an error here if the child argues, refuses to leave the table or room, refuses to let go of game materials, cries, pleads, sulks, etc.

Experimental Test Games

The three pre-experimental games were the Cup Game, the Spinner Game, and Star Lady. These games will be described in the order in which they were used in the experimental test situation.

1. Cup Game

Equipment: Twelve opaque paper cups, six small red rubber cubes, one small blue rubber circle, and one white 3 x 5 inch card for each player.

Procedure: Players sit around a table and hide their eyes. Order of play in the first game is designated by the game controller. In all other games the winner of the preceding game goes first. This procedure applies to all seven games described in this section. Players look under cups in turn, remove block or circle if there is one and replace cup. Play continues until all seven pieces are found. Player who finds the blue circle gets one extra turn immediately.

Rules: Player must say "Red for me," "Blue," or "No red for me." Player must replace cup in upside down position. Players must hide their eyes while pieces are being hidden. Player must put the pieces they find on their cards.

Winner: The player who finds the most pieces.

2. Spinner Game

Equipment: A Winner Spinner board (Whitman), four same-color marbles per player and four containers.

Procedure: Players sit around a table. Each player is assigned a color (red, blue, or yellow) that matches one of the pie-shaped sections of the board. He is given four marbles and a container of the same color. The marbles remain in the container while the player spins. If he spins his color he may place one marble in the storage holes on the board. If he spins orange he misses one turn. The object of the game is to empty the container first.

Rules: Player must say "Winner Spinner," before he spins. Player must move a marble to storage if he spins his color. Player must not touch his marbles otherwise. Player must say "No turn for me," if he stops on orange.

Winner: The player who empties his container first.

3. Star Lady

Equipment: A deck of cards with four each of nine comic characters and one additional card covered with stars that is referred to as "Star Lady."

Procedure: Players sit around the table and dealer gives each player three cards. The player's task is to get rid of all his cards, he does this by trying to collect as many pairs as possible. He may put down a pair whenever he gets one. He must discard each turn. The Star Lady card serves as a Joker. Any player who gets Star Lady must declare it. The player has the option of using Star Lady at once to put down a pair or holding it. If the player holds it, the next player may elect to try to pick it from the holder's hand instead of picking from the deck which the dealer holds in her hand.

Rules: Player must say "Card, please," when it is his turn. Player must discard each time. Player must put pairs on the table in front of him. Player must say "Two the same," when he puts down a pair. Player must declare the acquisition of Star Lady. Player must spread cards face down on table if another player elects to try to pick Star Lady.

Winner: The first player to get rid of all his cards.

The midexperimental game was Fill the Holes.

4. Fill the Holes

Equipment: A Fit-A-Space Set (Lauri Enterprises), seven pennies for each player, and a set of colored paper cups - pink, blue, and yellow.

Procedure: Players sit around a table. Each player is given a round plastic space holder (red, yellow, or blue) with the same shaped holes in it, *i.e.*, each player needs the *same* shapes but in *different* colors. Each player is given seven pennies. Players look under cups in turn and remove piece if it is their color. If it is not their color they may collect up to two pieces that they hold in reserve to sell to other players. A player may buy a piece that he needs to win *or* he may buy a piece that another player needs to keep the other player from winning. The number of pieces hidden exceeds the number the players need. If two players bid for a piece the finder has to sell it to the highest bidder. The player who fills the holes in his space holder first wins.

Rules: If player takes the piece he finds he must remove the cup from the table. Player must sell if another player wishes to buy. Player must put pieces that he needs into holder at once. If player wants to buy from another player he must raise one hand silently. Player may not make an offer until game controller establishes whether there are other bidders.

Winner: First player to fill his space holder. Second place is determined by number of spaces filled and number of pennies.

The three postexperimental games were Domino Squares, Scrabble Match, and the Elephant Game (Parker). The games are described in the order in which they were used in the postexperimental testing situation.

5. Domino Squares

Equipment: A set of Color Dominoes (Whitman).

Procedure: Players sit around table with their eyes closed while game controller puts 20 Color Dominoes upside down on table and gives each player one Color Domino that has two colors on it. Color Dominoes are either single-colored or they have two colors. Each player's colors are different from those of any other player (blue-black, green-orange, yellow-purple). The player's task is to find two single-colored dominoes to match the two colors that he has on the domino that he has been dealt. Each player in turn picks up one domino from the table, keeps it if it is one of his colors, and discards it if it is not. If it is a color that another player needs the player who has picked it up may shuffle the pieces on the table as he replaces it to avoid having the other player see where it is placed.

Rules: Players must keep eyes closed while pieces are being put out. Players must replace dominoes that they don't need face down on table. Players must place dominoes they do need adjacent to their two-colored domino. Players must say "I'll take it," or "Not for me."

Winner: The first player to get two single-colored dominoes to match his two-colored piece.

2. Scrabble Match

Equipment:	A Scrabble board (Sel Right), four different colored plastic cubic tokens for each player, 28 tokens to match those given the players, and a shaker box with a hole large enough for a token to fall out when the box is turned upside down.
Procedure:	Players sit around a table. Each player is given four tokens which he places in a row in alternate squares along his side of the Scrabble board. Each player in turn turns the shaker box upside down and takes the token that falls out. If the token matches one that he has on the board he says "Take two away" and hands them to the dealer. If the token does not match he puts it back in the shaker box and the dealer gives the box a good shake. The object of the game is to get rid of all four tokens.
Rules:	Player must say "Over you go," as he turns shaker box. Player must say "Take two away," if he gets a match (as he hands the pair to the dealer). Player must replace token he cannot use in shaker box. Player must never shake the shaker box.
Winner:	The first player to get rid of all his tokens.

3. Elephant Game

Equipment:	A Peanut the Elephant board (Parker), an elephant marker for each player, and a set of Symbols Cards with one, two, or three red legal stickers on each card and a Joker.
Procedure:	Players sit around a table. Each player is assigned a marker which he places in the bus-stop that is the same color as his marker (red, green, or blue). The object of the game is to get on the bus and go home. To get on the bus a player must draw a two from the pack of cards held by the dealer, a two entitles him to start in the first space. From then on he moves according to the card he draws, e.g., he takes one, two, or three steps with these exceptions: if he lands on orange he takes a slide of seven spaces to a jungle which is clearly marked; if he lands on green he is lost in the jungle and cannot get out till he draws a three; if he gets a Joker he goes all the way home.
Rules:	While a player is at the bus-stop he must say "Two, please," when it is his turn to draw a card. When

he lands on orange he must say "Slide". When a player moves his marker he must make it hop the number of moves indicated by his card, when he is allowed to slide he can do it anyway he wishes. Player must move his own marker (Penalty for moving the wrong marker is to move two steps back).

Note: We have modified the board so that each player has his own track, there is no overlapping.

Winner: The first player to get home.

APPENDIX C

Social Participation Scales Form

SOCIAL PARTICIPATION SCALES

Name ______________________________ Date ____________ Rater ____________

On each of the following scales a score of three means active participation, two means that the child will participate if he is encouraged to, and one indicates that the child does not participate in social situations.

A. Verbal behavior:

3 - Voluntarily joins ongoing conversation
2 - Joins ongoing conversation only if addressed
1 - Does not converse with others

B. Cooperative play situations:

3 - Voluntarily participates in cooperative play
2 - Joins cooperative play only when invited
1 - Does not participate in cooperative play

C. General play groups:

3 - Voluntarily joins in ongoing play
2 - Joins ongoing play only if invited
1 - Does not join group play

D. Group vs. solitary play preference in experimental setting:

3 - Prefers group play in choice situation
2 - Prefers group play only if other children appear to be necessary to game
1 - Prefers solitary play in a choice situation

E. Group vs. solitary play preference in classroom:

3 - Voluntarily goes where other children are
2 - Goes where other children are if directed to or if invited
1 - Goes to areas where there are no other children

F. Group vs. solitary play preference on playground:

3 - Voluntarily goes where other children are
2 - Goes where other children are if directed to or if invited
1 - Goes to areas where there are no other children

APPENDIX D

Preference for Social vs. Solitary Play Form

Descriptions of Situational Tests, Doll Play Procedures, and Incomplete Story Items.

PREFERENCE FOR SOCIAL VS. SOLITARY PLAY

Name ______________________ Date ____________ Rater ________

1. Situational Tests

   A. Playground (1)________ (2)________ (3)________

   B. Classroom (4)________ (5)________ (6)________

   C. Experimental Room (7)_______ (8)_______ (9)______

2. Doll Play

   a. ____

   b. ____

   c. ____

   d. ____

   e. ____

3. Incomplete Stories

   a. ____

   b. ____

   c. ____

   d. ____

   e. ____

   f. ____

   g. ____

   h. ____

   i. ____

   j. ____

Administration of Preference for Social vs. Solitary Play Items

I. Situational Test

The same procedure was followed in all three settings. The S was shown an attractive toy and was asked if he would like to play with it. Next, he was told that he could play with it alone or he could ask another child (or other children) to play with it with him. The S was given as much time as he needed to state his preference. The E was careful to remain neutral concerning the S's preference. The order in which the two alternatives were presented was varied according to a prearranged schedule to avoid emphasizing either. The toys used in the different settings were the following:

(a) playground - boys' toys: a set of boats in water, a marble game, and a set of guns and army equipment; girls' toys: a set of rubber balls, dress-up clothes for three people, and a block game.

(b) classroom - boys' toys: a farm set, a set of building blocks, and a target kit; girls' toys: a well-equipped doll house, a coloring set, and a maze floor game.

(c) experimental room - boys' toys: a racing car set, a train game, a Batman kit with dress-up clothes; girls' toys: a tea set, a set of dolls with baths, and a cooking set with good mixes.

II. Doll Play

The standard doll play procedure was followed. The E began a story that concerned a same-age, same-sex doll character who was offered a choice of solitary or social play. The E then gave the doll to the S and asked him to show her which of the two alternatives the doll chose. The order of presentation of the two alternatives was varied according to a prearranged schedule.

Prior to the presentation of the test stories the E gave the S two practice stories and then allowed the S to make up a story for the E to finish. The first test story is given in detail. The same format was used for the other four stories.

(a) Here's a boy who is five years old just like you. This boy's name is Jimmy and here is Jimmy's mother. His mother says," Jimmy, it is a hot day. Would you like to go swimming?" Jimmy says, "Oh boy, I like swimming, I will take some toys to the beach too." Next his mother asks him if he would like to go swimming all by himself (because the beach is very close) or if he would like to ask his friends to go too. His friends live over here. You show me what Jimmy does. Does he go swimming with his friends or does he go swimming all by himself?

(b) Playing in a park with lots of equipment for active play.

(c) Playing with a box of surprise games.

(d) Playing with a clay modeling and painting set.

(e) Playing with a well-equipped toy store.

III. Incomplete Picture Stories

In each story the materials used consisted of a set of three pictures. The first picture structured the story and defined the alternatives, this picture was placed on the table in front of the S as the first part of the story was told. Next the S was shown two pictures each representing an alternative, these two pictures were held in front of and equidistant from the S. He was asked to pick the picture that finished the story. The E emphasized that the S could end the story any way he wished. When the S selected one picture this picture was placed next to the first picture and then the E told the S that they had made up a story and she reviewed the story. As the E placed his choice picture in front of him she removed the alternate choice picture. The order of verbal and pictorial presentation of the two alternatives was varied according to a prearranged schedule. Two practice items were used. The story child was always same-age, same-sex as the S.

(a) "Look, here's Tommy and here's his daddy, and look what's this that his daddy has for Tommy (PAUSE while S identifies toy, activity). Yes, its a jungle gym with swings and rings, isn't it? Now, Tommy's daddy says that Tommy can play on this all by himself or he can have some friends come over and play on it with him. Look, here are some pictures that we can use to make up the rest of the story. (Show pictures, verbalize alternatives again.) Now, you show me what Tommy does. Pick the picture that shows what Tommy does and we'll put it here with this other picture (point to first picture) and then we'll have a story." Same story suitable for boys and girls.

(b) Indian clothes, wigwam, bow and arrows, Indian doll.

(c) A set of multicolored activity trucks (boys). A set of dolls and doll furniture (girls).

(d) A child's movie projector, slides, and screen.

(e) A boat set (boys). A kitchen set (girls).

(f) Butterfly nets and jars.

(g) A set of guns and cowboy hats (boys). A set of dress-up clothes and make-up (girls).

(h) A tree-house with a ladder and many attrative features.

(i) A printing machine (boys. A set of ready made jewellery and a jewellery materials kit (girls).

(j) A sidewalk store.

Note: The S was given five items on one day and the remaining five another day.

APPENDIX E

Handbook of General Game Skills Training Procedures

I. Introduction

II. General Game Skills

III. Use of Number Concepts in Game Context

IV. Description of Types of Games Used

V. Description of One Game Session

I. Introduction

A. Purpose: The purpose of this handbook is to describe a training program in which young, educable, mentally retarded children learned general game skills and beginning number concepts through the medium of small group games.

B. Age and ability level: This training program was designed for educable, mentally retarded children who ranged in age from four years, five months, to nine years, eleven months, and in IQ from 51 to 79 on the Stanford-Binet Intelligence Test. The program has also been used with culturally deprived children and slow learners in Kindergarten and the first grade and young normal children and has proven to be effective.

C. Main emphasis: The feature that distinguished this training program from those of other investigators was an emphasis on the direct teaching of social behavior in the form of general game skills with beginning number concepts being an integral part of the activity but incidental to the intentional teaching of general game skills. There was little or no direct teaching of number concepts. Instead, the manipulation of number became an intrinsic part of the game activities, it was a means to an end *i.e.*, playing the game, rather than an end in itself.

D. General characteristics of the program:

1. Length of sessions. Each child participated in three 35 minute game sessions per week for nine months with two or three classmates as players and an adult as the game controller.

2. Type of games. A variety of active, moderately active, and table games were played in each session. The games used were colorful, exciting, and were appropriate for the age and sex of the players.

3. Control of games. The outcome of the games could be partially or completely controlled by the game controller. No player was allowed to experience a long series of losses. The controller did not allow the players to play any game too often or for too long a period. She stopped the game while interest was high rather than waiting for the players to want to stop.

4. Active participation. The games used required the active participation of all players; no elimination games were used. When a game called for some kind of elimination, points were scored against the players but they were left in the game. At the end of the program the idea of elimination was explained and demonstrated to the players in order to familiarize them with this procedure.

5. Intentional teaching of general game skills. In each session the game controller directly taught one or more general game skills to the players. She provided immediate reinforcement of good game behaviors and immediate reprimand of poor game behaviors. The only required

behaviors in the game situation were the general game skills that had been taught in previous sessions, or that were currently being taught, and the specific rules of the game being played.

6. Beginning number concepts. In each session the game controller introduced many beginning number concepts incidentally within the game context but made no attempt to teach these concepts directly. Each game procedure required the use of two or three kinds of number Knowledge. When a player could not remember a response that required some kind of number Knowledge the game controller told him what to say or do but she did not emphasize the number response in any way.

7. Use of rewards. When a player won a game the game controller praised him and gave him a symbolic reward on a scorecard. When each square on his scorecard was filled the player was allowed to choose a small tangible reward which he took home and kept.

8. Individual pacing of players. Each game could be modified to allow pacing of individual players. Special help was given to any player who was experiencing difficulty with the general game procedures.

9. Use of adult models. In some sessions a second adult, the adult model, participated as a player and made the kinds of errors that were causing the child players some difficulty. The game controller reprimanded the adult model and urged the players to help her. This procedure diverted criticism from the players and caused them to engage in overt and covert rehearsal of the general game skills.

10. Leadership training. The games used in the program were ones that the players could play without supervision. This procedure provided an opportunity for individual players to act as leaders.

11. Modification of rules. The players were encouraged to suggest additional rules for the games and to recommend changes in existing rules. Occasionally when a new game was introduced the game materials were spread out and the players were encouraged to look at the game and to decide how the game could be played.

II. General game skills

General game skills are the skills that are prerequisite to successful participation in the small group table and active games of childhood. The intentional teaching in this game program consisted of ten general game skills. Each of these game skills is defined and the procedure for teaching it is described in detail.

A. Behavior while the game controller is explaining how to play the game: This skill refers to the way the child behaves while the game controller is explaining rules and demonstrating procedures. Score an error here if the child is restless, disruptive or inattentive. We will infer that the child is not attending if he becomes absorbed in handling his clothes, looking around the room, if he leaves the table without a good reason, talks to the other children about irrelevant matters, or wants to stop playing.

1. Teaching procedure: We started with very simple games that could be explained in a sentence or two. At the beginning of the program the players were encouraged to place one hand on each knee while the game was being explained. The game materials were displayed one at a time in order to allow the game controller to describe the game procedures in a logical order and to focus the players' attention on each piece of game equipment. In the teaching of this and each of the following game skills the adult controller provided immediate reinforcement of the players' good and bad behaviors and used the adult model whenever the players had consistent difficulty with a particular game skill.

2. Recommended games for teaching this skill: Penny Game, Animal Card Game, Whistle Stop.

B. Plays in turn: This skill refers to the child's ability to take his turn promptly. Score an error here whenever the child has to be reminded to take his turn and also if he plays out of turn.

1. Teaching procedure: We first used simple games to demonstrate that if everyone took turns at once it was difficult to tell who was the winner. Next we showed the players that if one player played too soon the player who had missed his turn did not win when he might easily have been the winner. The adult model was particularly useful in these demonstrations. We then had a discussion about other kinds of taking turns such as lining up at the slide on the playground. Next we set out the game and had each player put his hands on his knees until his name was called. He then took his turn and put his hands back on his knees. Within a few days it was not necessary for the player to put his hands on his knees but the game controller did continue to call the player's name if he did not immediately play in turn. If a player took more than one turn when it was his turn to play, the game controller stopped him but did not emphasize the error.

These two game skills (behavior while the game controller was explaining how to play the game, and playing in turn) can be introduced at the same time with the same games. No other game skills should be taught until the players are quite proficient at these two skills.

C. Takes one turn: This skill refers to the way the child behaves when it is his turn to play. Score an error here if he takes more than one turn at this time.

1. Teaching procedure: We used games in which the player took pieces from the table rather than from the game controller and the order in which pieces could be picked up was clearly established. The games could be set out so that two winning cards or objects occurred in sequence. When a player took more than one turn it was clear to the

other players that that player had won two times and that, as a result, the next player did not win at all. The other players reacted indignantly to this sequence of events and typically expressed strong disapproval. We often used small edibles to demonstrate this rule.

2. Recommended games for teaching this skill: Animal Card Game, Symbols Card Game, Casper the Friendly Ghost Game.

D. Behavior between turns: This skill refers to the way the child behaves when it is not his turn to play. Score an error here if the child fails to attend to the game when it is not his turn. We will infer that the child is not attending if he becomes absorbed in handling his clothes, looking around the room, if he leaves the table without a good reason, talks to the other children about irrelevant matters, wants to stop playing, or acts aggressively towards the other children.

1. Teaching procedure: We played games in which a player could get points if he watched what the other players were doing. If a player did not attend the game controller would point out some opportunities that he had missed to gain points in this way. The game controller also introduced variations of the ongoing game that allowed any player to make a move if a certain signal appeared thus penalizing the player who was not attending.

When aggression between players occurred the game controller stopped the game and explained to the players why this behavior could not be allowed. She also pointed out to the players that when aggression or any other behavior caused the game to be delayed the players had fewer games and fewer rewards. She further emphasized the undesirability of aggression by getting out a new, interesting-looking game and telling the players that there would not be time to play that game because the players had wasted so much time. Instances of aggression between players were rare. (It should be noted that it is important to avoid crowding in seating the players at a table or in positioning them for more active games).

2. Recommended games for teaching this skill: Symbols Card Game, Tricky Dick-Variation (a), Take a Chance Game.

E. Accepting the game controller's decisions: This skill refers to the child's willingness to accept game controller's decisions about arguments, rules, seating plans, choice of game, etc. Score an error here if child refuses to abide by controller's decision or if he shows extreme reluctance.

1. Teaching procedure: We used two procedures to teach this skill. First, we used games such as race-type games in which there was some question of who was the winner and we allowed the children to argue. Generally, no one won under these circumstances. Then we pointed out to the players that it was no fun when everyone spent all their time

arguing and no one won. Second, we taught the players some very simple games in which winning and penalties had to be decided upon by the game controller and we had each player act as the game controller. This procedure proved to be an extremely effective one. The players quickly saw how unpleasant it was for everyone, including the game controller, if there was much dissent.

2. Recommended games for teaching this skill: Colored Shapes Game-Variation (a), Whistle Stop-Variation (a), Susie Says Game.

F. Follows specific rules of the game: This skill refers to the child's ability to follow the rules specific to the game being played. Score an error here if the child breaks a specific rule.

1. Teaching procedure: During the sessions in which we taught the Game Skills A through E we helped the players with the specific rules. As soon as the players were proficient in Game Skills A through E we imposed penalties on players who failed to observe the specific rules of the game. When we started to impose penalties we used very simple games and then, as the players became more able to remember the specific rules we gradually increased the difficulty level of the games.

2. Recommended games for teaching this skill: Penny Game, Symbols Card Game, Colored Strip Game, Hopalong.

G. Being a good loser: This skill refers to the child's reaction to losing while the game is still going on or after the game is finished. Score an error here if the child is a poor loser, e.g., sulks, cries, complains, refuses to play anymore, etc.

1. Teaching procedure: The players were frequently very distressed when they lost and often exhibited aggression or withdrawal. We used the adult model frequently to demonstrate to the players that this kind of behavior markedly reduced the pleasure of the game for the other players and that it delayed play. We also set up some games where everyone won to show the players that it was more fun when only one person won. Whenever it was appropriate to do so, the game controller played with the child players and served as a model. It was really difficult to teach the players to be good losers. We wished to accomplish the intentional teaching of game skills completely through the medium of games so that we were not able to use other types of instruction. However, we would strongly recommend that in a more general program stories be used to emphasize the importance of being a good loser.

2. Recommended games for teaching this skill: Colored Strip-Variation (a), Cat and Mouse, Gingerbread House, Whistle Stop, Musical Chairs.

H. Accepting that the game is over: This skill refers to the child's willingness to accept that the game is over. Score an error here if the child argues, refuses to leave the table or room, refuses to let go of game materials, cries, pleads, sulks, etc.

1. Teaching procedure: We had very little trouble with this skill. Players were sometimes reluctant to accept that a game was over when they felt that they were close to winning. We did not allow each player to finish a game when one player had won because we did not want any player to be sitting waiting for the rest to finish. Further we did not play any game for too long or too often because we felt it was preferable to stop while the players were still very interested in the game.

2. Recommended games for teaching this skill: Hopalong, Colored Shapes, Gingerbread House, Cat and Mouse.

I. Handling the game materials only at appropriate times: This skill refers to the child's handling game when the pieces are being set out by the game controller or another player, or to his handling pieces that he should not touch during the game at all, e.g., other players' cards, or to his handling the game or center pack of cards when it is not his turn. Score an error here for any of the above.

1. Teaching procedure: To teach this skill we stopped the behavior whenever it occurred and explained that it was difficult for the player who was playing in turn to see what move to make if everyone else was handling the game. If a player knocked over game materials or disrupted the game in any way with this behavior, the game controller emphasized the importance of handling the game materials only at appropriate times.

2. Recommended games for teaching this skill: Penny Game, Colored Snake Game, Hopalong Game.

J. Handling the game materials with reasonable care: This skill refers to the care with which the child handles the game materials. It is important to make allowance for accidents and clumsiness. Score an error here if the child appears to deliberately tear, drop, bend, break or throw game pieces.

1. Teaching procedure: The players were fairly careful with the game materials except when they were angry about losing or about incurring some penalty. The game controller stopped this behavior when it occurred and reprimanded the player sternly. There was relatively little problem with either this game skill or the one described in the preceding section. For this reason these two skills were the last to be directly taught to the players. It is important not to confuse careless handling of the materials with clumsiness. Retarded children often have poorly developed fine motor skills and find the handling of small game pieces difficult.

2. Recommended games for teaching this skill: Penny Game, Checker Pot.

III Procedure for Using Number Concepts within the Game Context

The manipulation of number was an intrinsic part of the game activities, with each game procedure requiring the use of at least one number term. The specific number terms and terms of a qualitative or quantitative nature that are typically included in the number activities of the first grade are listed in the descriptions of game procedures in the Handbook. In addition, the game controller was able to introduce many number terms incidentally within the context of the game. The following examples are representative of this procedure.

A. Rational counting: The game controller used rational counting whenever she gave out markers for a game. She would count the players and then count out the number of markers needed, this number frequently exceeded one per player. The players frequently asked how many stars they had on their scorecards or how many more they needed to fill the card. Rational counting was also used in games where players accumulated tokens or had to make more than one move.

B. Ordinal numerals: The game controller used ordinal numerals regularly to denote order of play and to explain how to set out markers in a particular sequence.

C. One-to-one correspondence: The game controller used this concept when she gave out markers or tokens, when she set up chairs for play and when she gave out symbolic rewards in the case of a tie.

D. Comparative Terms: The game controller used these terms regularly in deciding winners, e.g., "John has more pennies than Billy, Peter has the most, I have the least;" in deciding order of play by picking straws, e.g., "He has the longest, you have the shortest;" in comparing scorecards and in comparing length of turns.

E. General number terms: The game controller used general number terms whenever an opportunity occurred in the game procedure. Among the terms used regularly were the following - "How many have you"? "Let's count these", "Let's play a fast game, we have time for one more," "Put the red one under the blue one, I'll put mine beside yours, I have as many as you." "How many are there all together? "Stand up, sit down, move over." "Here's one for each of you." "Put your right hand on the chair, put your left hand." Let's sit in a circle". "Here's a square for you." Put it in the round hole."

F. Specific groupings: The game controller used specific groups whenever it was possible to arrange the game materials in this manner, e.g., "I'll put three markers here and two markers here. Here's a pile of four markers for you."

G. Spontaneous use of quantitative terms: When the players used quantitative terms spontaneously the game controller repeated them if this could be done smoothly, e.g., "Billy says he has the most stars, let's count everyone's stars and see if he has the most".

IV Descriptions of the Types of Games Used in this Program.

The purpose of this section is to suggest the types of games that can be used. Only a few specific rules are suggested for each game, the number of rules should depend on the maturity of the players. The players will suggest many variations for each game if they are encouraged.

A. Table Search Games: In these games a number of containers are placed on a table and the players must find the object or objects that are hidden under them. If identical containers are used the players gain practice in place memory whereas if a variety of containers are used the players learn to remember specific attributes of the containers. In these games only one object may be hidden with all other containers being empty. A more interesting procedure is to have objects under or in almost all the containers with some objects being very valuable finds. The players in this program also enjoyed looking for the only container on the table that was empty. To finish the game quickly we sometimes had players remove the containers after they had looked under them or look under two containers at a time. This type of game is excellent for giving practice in the identification of money, shapes, color, and small groupings. Examples of table search games include the following:

1. Penny Game
Area: Indoors Type of game: Quiet table
Equipment: Twelve or more opaque containers, *e.g.*, plastic boxes, paper cups. Pennies.

Players sit in a circle at a table or on the floor. The containers are set out upside down in an irregular circle. While the players hide their eyes the game controller hides one, two, or three pennies under all but three of the containers. The game controller then designates the order of play arbitrarily, or by picking straws and having the player with the longest or shortest straw play first, or by thinking of a number from one to five and having the player who guesses the number go first. Play is always clockwise in the table games. As the player takes his turn he must say "no penny," "one penny," etc., and replace the empty container. Each player keeps what he finds until the end of the game. The winner is the player who finds the most money.

Specific terms that should be used in this game: No, penny, one, two, three, nothing, under, over, all, most, pile (of pennies), few, lots, everyone, all together, and count. In this and in each of the games in this section the alert game controller will find many opportunities to use number terms.

(a) Object variations: Many different money combinations, shapes, colored objects, or groups of objects may be used.

(b) Procedure variations: Players may remove the empty containers or they may pick up two containers at a time in order to speed up play.

(c) Game area variations: The containers may be placed around the room with objects hidden under them and *each player is given a different task*, *e.g.*, "Find all the round red things you can." "Find all the blocks that are the same as this one." The players race to complete their assignments. Placement of containers to avoid collisions is especially important.

2. *Take a Chance Game*
Area: Indoors Type of game: Quiet table
Equipment: Twelve or more paper cups of *four* different colors. These may be obtained at any grocery store. A variety of coins and written instructions.

Players sit in a circle at a table or on the floor. The containers are set out in an irregular circle. While the players hide their eyes the game controller sets out low value objects under all the yellow cups, moderately valuable objects under all but one of the blue cups, very valuable objects under only *half* of the pink cups, and messages under the white cups. The messages sometimes offer a major bonus to the player and sometimes impose a penalty. The game controller then explains to the players that sometimes taking a chance pays off and at other times it causes a loss. She shows them what the different colors mean. Players must indicate their choice verbally, *e.g.*, "I'll take yellow, blue, pink or white." The game controller should make appropriate comments, *e.g.*, "You're taking a little chance (blue), a big chance (pink), a very big chance (white)."

The game controller reads the messages to the players, *e.g.*, "This message says you can get two turns instead of one right now." "This message says you have to give three pennies to the player on your left right now."

The players found this game very exciting, they quickly grasped the idea of chance *vs.* certainty of a small gain.

Specific terms that should be used in this game: all but one, under, over, half, little, big, very, left, right, two turns together, every, how many, count, most, everyone, always, pile, only, and last.

(a) Avoiding penalty variations: Some messages can allow the player to avoid the penalty by paying a fine to the game controller *e.g.*, "miss three turns or pay three pennies."

B. *Card games*: In these games players pick up and discard from a pack of cards on the table or from a pack held by the game controller. Many variations are possible within this general framework. To win a player may have to have a set of identical cards, a set of cards in which no two cards are the same, or a set of cards in a particular numerical or pictorial sequence. Players may be allowed to trade with each other instead of picking from the pack and this trading may be mandatory if one player requests it or it may be only by mutual consent. If one card is particularly valuable players may be allowed to pick from the hand of the player who holds that card rather than from the pack. This type of game is excellent for giving practice in the identification of similarities and differences, in the use of comparative terms, in the naming of common objects, and in recognition of small groupings, colors, and shapes. The following card games were used.

1. Animal Card Game
   Area: Indoors   Type of game: Quiet table
   Equipment: A set of 30 small, white cards with an animal sticker pasted on each card.

Players sit in a circle at a table and the game controller hands each player a card which the player identifies, *e.g.*, "horse", "lion". The player then places the card on the table in front of him. As the player takes his turn he must say, "Card, please," to the game controller, then identify the animal on the card. He keeps the card and says "same" if it matches the card he has on the table. He discards the card and says "different" if it does not match his card. The winner is the first player to collect three identical cards.

Specific terms that should be used in this game: same, different, another, each, on, one, two, three, everyone, first, next, every, how many, row, last, only, and more.

(a) Card variations: The winner may need three different animal cards, or depending on the card pictures a bird, a fish, and a jungle animal.

(b) Trading variations: Each player is given two cards and trading by mutual consent is allowed.

2. Symbols Card Game
   Area: Indoors   Type of game: Quiet table
   Equipment: A set of 30 small white cards with one to three red legal stickers pasted on each card.

Players sit in a circle at a table or on the floor and the game controller hands each person two cards without allowing the other players to see them. Players pick from the table pack and discard if they wish to. The winner is the first person to get a run, *i.e.*, a one, two, and three cards.

Specific terms that should be used in this game: thirty, one, two three, same, different, up, down, two for each, around, more, last, all, row, and first.

(a) Joker variation: The players are told that they may substitute the Joker for any card.

(b) Three of a kind variation: To win a player may have a run or a set of three of a kind.

(c) Suit variations: When the players were proficient in (a) and (b) we added two new suits - a blue sticker suit and a gold sticker suit. Runs had to be in one suit, but sets could be three different suits.

(d) Pairs variation: Each player was given a pack of 10 cards which he held face down. Players discarded cards one at a time. If two identical cards were discarded in sequence the first player to call "pairs", was given those cards to keep on the table not in his hand. The winner was the player who accumulated the most pairs.

C. Track Board Games: In these games all players share a game board and roll dice or spin dials to determine the number or direction of moves they may make. The board games that we used had many hazards, penalties, and bonuses, and were generally exciting. We used five levels of board complexity; in the simplest games (the first level) each player had his own straight line track and he moved along that track from the starting point to the goal without ever encountering another player. At the second board level the player had his own track but the track was a winding one. On third level boards the player's track overlapped with those of other players but only for a few squares. At the fourth level the players all used the same straight line track upon which all players moved in the same direction, and at the fifth level all players used winding tracks upon which they could move in several directions. The following games are examples of the five levels.

1. Parchesi (Parker) A first-level track.
Area: Indoors or outdoors Type of game: Exciting table Equipment: A parchesi board, large markers and a set of dominoes.

Players sit in a circle at a table. Each player is assigned a starting point on one of the straight line tracks leading to the center goal. The game controller places all the dominoes face down on the table. As a player takes his turn he picks up a domino, counts the number of dots, announces the total, and moves his marker accordingly. The winner is the first player to reach the center goal.

Specific terms that should be used in this game: one for each, begin, end, over, all the way, first, around, count, first, last, fast, slow, everyone, no one, soon, quick, and most.

Note: Particular care should be taken to see that the players really understand how to move a marker on a game track before any more complicated track game is used. Our players had great difficulty remembering to count their first move forward as one, they tended to count their present position as one and to call their first move forward two. They were also extremely innacurate about their moves, they could count accurately but they could not count and move accurately at the same time.

We do not recommend any variations. Instead, we suggest that players use this game until they are quite proficient with dominoes and can move accurately. Use dominoes within the counting ability of the players. For the more able players you may use large dice that are clearly marked with only one, two, or three dots. It is best to start with a *single die* and to give the players a long period of practice with the single die before allowing them to use a pair of dice. A regular die with one to six dots may be used next and then a pair of regular dice if the number combinations are within the counting ability of the players. These domino-dice procedures may be used for all the board games described in this section.

A dial spinner is another good technique to use to determine moves. The dial spinner should be strong, easy to spin, and should be marked off in three or four sections. A firm policy should be established concerning the procedure if the dial indicator stops on the line between two sections. Dial spinning may be substituted for dominoes and dice in any of the board games.

2. *Casper the Friendly Ghost* (Bradley) *A second-level game.*
Area: Indoors Type of game: Exciting, table
Equipment: Casper board and a pack of 30 cards with one to six symbols and three Jokers.

Players sit around a table or in a circle on the floor. Each player is assigned four same-color markers and a corner of the board. Each corner has a starting-point square that is clearly marked. The player draws a card from the pack, and moves his first marker accordingly. The route for each player is a U, he must move left for three squares, right for two squares, and then right again for seven squares into the Haunted House. If a player draws a Joker he may move his marker on the board directly into the Haunted House. The first player to get all his markers into the Haunted House wins the game.

Specific terms that should be used in this game: four for each, one at a time, start, finish, begin, end, straight along, turn right, again, how many, all the way, over, seven, three, two, into, out of, fast, slow, quick, and a lot.

(a) Penalty variation: When a player draws a Joker he moves his marker on the board directly to the Haunted House, all other players must move their markers on the board, *i.e.*, in play, directly back to the starting-point square. *Note*: markers already in the Haunted House are safe.

3. *Cat and Mouse* (Parker) *A third-level game*
Area: Indoors Type of game: Exciting table
Equipment: A Cat and Mouse board and markers and a pair of large dice or a set of dominoes.

Players sit around a table. Each player is given two same-color mice markers and is assigned a starting-point square in the corner of the board nearest him. The player's route is the two horizontal lines of squares parallel to his side of the board, i.e., the player moves in an elongated U from starting point to goal a total of 14 squares including cat traps. The player rolls dice and moves accordingly. The winner is the player who gets the most mice safely home, or in the case of a tie the player who gets there first.

The U-shaped route provides an overlap area of four squares at each end of a player's two rows. Our players found the overlap difficult to handle accurately. The two main errors were using the wrong marker and moving along the wrong route. We marked each starting-point square and goal box with the same color as the markers for that route.

Specific terms that should be used in this game: start, finish, two rows for each, along, down, both, same, over, into, begin, end, last, first, next, at last, all the way, most, only a few, and least.

4. Hopalong A fourth-level game
Area: Indoors Type of game: Exciting table
Equipment: A checker board with the squares on the perimeter left visible and a square of green paper covering all the remaining squares. A set of 20 black checkers, 10 being all black and 10 having a small red circle on one side

Players sit around a table in a circle. Each player has a marker called a rabbit. All the markers are placed on the starting-box square which is clearly marked. The object of the game is to be the first rabbit to reach the goal, which involves going around all four sides of the board. The checkers are all face down on the green area. It is impossible to tell which ones are partly red. As a player takes his turn he picks up a checker and identifies the color "black" or "a red spot." He moves his checker to the nearest square that matches his checker in color, counting the squares as he does, e.g., "one hop, two hops." However, if another player is on the nearest same-color square than he may jump over that square to the next same-color square and stop there if that square is vacant. No two markers should ever be on the samesquare with the exception of the starting square. A player who forgets to count his hops must go back to the starting-box square. The player must put his checker back in the center green area after he has moved.

Specific terms that should be used in this game: start, finish, first, along, all the way around, four sides, only, never, one on each, square, red, black, everytime, more,over it goes, fast, slow, quick, now, and soon.

(a) Color variation: Players may hop only when they pick up an all-black checker. If they pick up red they move back to the preceding black square unless they are already in the starting box.

5. Gingerbread House (Sel Right) A fifth-level game.
Area: Indoors Type of game: Exciting table
Equipment: A Gingerbread Board, dice or dominoes and small checkers painted different colors as markers.

Players sit around a table in a circle. Each player is given a different colored checker to use as a marker. The place on the game board where there are five candies near the lower left corner is marked with a square of colored paper. This area is the starting point. Players move by die or domino. The object of the game is to be the first player to make a complete circuit of the board. If a player's move ends on any of the candy figures that are immediately adjacent to squares with crosses in them he gets two free turns at once and he may cut through the center of the board instead of going around the outside row of squares. The Gingerbread House in the center counts as one square. Short cuts may result in a penalty. If the player's two moves end on any of the candy figures in the center area he must miss a turn and when he does get a turn he must go back to the outer circuit by the path he used to enter.
Note: We do not use any of the three-dimension parts of the board in this game. The game provides excellent practice in track play. When a player can use this board without making errors in direction of moves or use of marker he can be considered to be proficient in track game procedures.

Specific terms that should be used in this game: around the outside, edge, all the way, shortcut, quicker, chance, no turn, same, back, through, over, how many, end, finish, start, first, and last. Note: re the five Track Board Games. All five games are excellent games when played according to their manufacturers' rules. We modified them to provide the players with specific kinds of track practice. Our most able players were able to learn the procedure of Checkers although they never developed any strategy. We recommend Chinese Checkers for the more able players.

D. Symbol Board Games: In these games the object is to match the symbols on the board with identical concrete articles, *e.g.*, coins, shapes, or colors. Players may obtain the articles through search, strategy, or speed. In the latter case a pile of wooden shapes may be placed in the center of the table and the players may have a race to see who can fill their section of the board first. The symbol board games that we used included the following games.

1. Colored Strip Game.
Area: Indoors Type of game: Quiet table
Equipment: A ruler-shaped board with a row of different colored squares and a set of small squares that have a color on one side that matches one of the colors on the board and that are neutral on the other side.

Players sit around the table and each player has his board in front of him. The small colored squares are spread out neutral side up, in the center of the table. The player's task is to find one square to match each square on his board. As he takes his turn he must hold up the square he picks and say what color it is and then place it on his board. If he already has that color he replaces it neutral side up on the table. He can fill up his board in any order that he wishes. He is encouraged to watch and remember where other players discard squares that he needs. The winner is the first player to fill his board.

Specific terms that should be used in this game: one for each, all, every one, on, underneath, already, only, first, next, last, everytime, which ever way, nothing, full, and all colors.

(a) Direction Variations: The player must fill his board from right to left or from left to right. Players keep all the pieces they pick up and trade them. A multi-colored, same-size square is placed on the table and serves as a Joker. The Joker can be used on any square and the player who owns it can trade it for three pieces that he needs.

2. Colored Shapes Game
Area: Indoors Type of Game: Quiet table
Equipment: A board with many different colored shapes in the form of a big X. Four players may play, each player has one arm of the X.

Players sit in a circle with the board placed so that each player has his arm of the X directly in front of him. Many different colored shapes are placed colored side down in the center of the table. The player's task is to find the pieces that match the colored shapes in his arm of the X, i.e., they must be the right shape and the right color. He must begin with the shape nearest him and fill each subsequent shape. When it is his turn he must pick up a piece from the table, name it, e.g., red triangle and put it on his board if he can use it. If not, he replaces it color side down in the center of the table. No trading allowed.

Specific terms that should be used in this game: Same as those used in the Colored Strip Game that immediately precedes this game and the following: into, all shapes, straight, corners, nearest, in this order, all the way along, one after the other, and the very last.

(a) Race Variations: Players have a race to fill their arms of the X. All players select pieces at once and fill the sections in any order. Players must replace pieces they cannot use color side down in the center of the table. Trading is allowed by mutual consent.

3. Scrabble Board Game
Area: Indoors Type of Game: Table, exciting
Equipment: A Scrabble Board with a row of different objects (money, shapes) glued one to each square on the second row in from the edge. The square at the end of each line of objects is left empty. A dial

spinner with zero, one, two and three in clearly marked sections. A set of objects to match the objects glued to the board.

Players sit around the table and each player spins in turn. A player may take as many objects as the number when the indicator stops. If he spins zero he must say "Zero, that means nothing," if he spins one, two, or three he simply says the number of objects he may pick up. The first player to completely match his row with the row on the board wins.

E. Guessing Games: In these games each player signifies his guess in some way and the game controller then shows all players the right answer or the game controller shows the players a number of apparently identical objects and the players try to select the one that is different or the one that has the most of some attribute. The following guessing games were used.

1. Colored Snakes
Area: Indoors Type of game: Quiet table
Equipment: Colored pipe cleaners in sets of five. Each set is the same in color but different in length.

Players sit around the table. The game controller holds a set of five pipe cleaners so that it is impossible for the players to tell which is longest. Players pick a pipe cleaner and when each player has one they are compared. The player with the longest (or shortest) one wins.

Specific terms that should be used in this game: same, different, long, longer, longest, short, shorter, shortest, one, which, and very.

2. Checker Pot
Area: Indoors Type of game: Quiet table
Equipment: Twelve or more opaque containers and a set of six black checkers and six red checkers.

Players sit around a table. The game controller hides all the black checkers under one container and all the red under another while the players hide their eyes. Each player in turn puts one finger on the pot that he thinks has checkers under it. The game controller then has the players look one at a time and the players that correctly identified the Checker Pots win. Only one player to a container.

Specific terms that should be used in this game: under, over, pile, which, on, one, two, six, only, all, everyone, first, next, and last.

F. Active Race Games: In these games all players move at once with the quantity and quality of the moves being designated by the game controller. Players are penalized for failure to obey the signals given by the game controller. The following race games were used.

1. Whistle Stop
Area: Indoors or outdoors Type of game: Active, exciting Equipment: A whistle and a starting and finish line.

Players all stand behind the starting line in a row. Game controller stands 10 or 15 feet away and designates the kind of steps (little jumps with both feet together, big steps, short hops) the players may take when she says "Go". Next she has the players practice the step she has designated. When she says "Go" the players all move forward using only the designated step, when she blows the whistle all players must stop immediately. The penalty for taking the wrong kind of steps and for failing to stop when the whistle blows is being sent back to the starting line. The first player to reach the finish line is the winner.

Specific terms that should be used in this game: all together, everyone, big, little, fast, slow, quick, as soon as, forward, backward, back to, first, last, next, always, line, here, and there.

(a) Reversal variation: This variation gives the slow moving child a chance to win and keeps the players on the alert. There is one addition to the above rules. If the whistle blows three times all players about turn and walk briskly back to the starting line. The first player to reach the starting line is the winner. The players really enjoy being the game controller for this game.

2. Susie Says
Area: Indoors or Outdoors Type of game: Active, brisk Equipment: A starting line and a finish line 10 or more feet away.

Players all stand in a line facing the game controller. Players must do whatever Susie Says. Game controller starts "Susie says take little steps, take one big step, take three little jumps, walk slowly, walk quickly, stand still, turn around, walk backwards, etc." First player to reach the finish line wins. Any player who fails to follow directions must return to the starting line.

Specific terms that should be used in this game: line, big, little, one to five, all together, everyone, right, left, forward, backward, now, and all.

(a) Hands Only Variations: Players move only their hands and arms, e.g., "Susie says give three claps, put your hands together, put your hands far apart." Game controller may model responses when she thinks it is necessary to do so.

3. Tricky Dick
Area: Indoors or outdoors Type of game: Fast exciting Equipment: A starting line and a finish line

Players all stand in a line facing the game controller. The game controller varies her instructions, sometimes she tells all players to take a specified number of steps, at other times she tells one player to move. Players can move when game controller is not looking. If she sees them they go back to the starting line. The signal that means the player's illegal move has been noted is this - the game controller points to him and all the players call out "Tricky Dick." Players quickly learn to try to distract the game controller so that they can sneak up.

Specific terms that should be used in this game: Same as those in the two preceding race games.

(a) Attention-directing variation: At a silent signal from the game controller all players may walk briskly to finish line. Examples of silent signals - game controller shuts one eye, puts both hands on top of her heard, etc.

In addition to these active games and their variations we played all the well known children's race games including Mother, May I?, Musical Chairs, relay races in which the players formed two three-man teams, races in which the players had to take some specific step such as hopping, and races in which players moved as fast as they could when one signal appeared and remained stationary when a different signal appeared.

V Description of One Game Session

At the beginning of the experimental period we had an observer record the content of a session in which the three players were completely lacking in general game skills and had almost no knowledge of number. Each of the game concepts and the game and number words that were used in this session is underlined. We have not always used direct quotation in this description.

We brought the players into the experimental room and the E said that they would need four chairs and a table, she asked the players to each bring one chair. When the players were comfortably seated the E told them that she had a good game for them to play and she asked them to tell her about the kind of games they played at home. Two players stated that they had never played a game. The third player described some procedures that appeared to be a game of Monopoly that her siblings engaged in and she concluded with:

> "but I can't do it right so they don't let me so I look at them and after I do it my own self."

The E then told the players that games were lots of fun and that you could "do it right" if you knew the rules because rules tell you what to do when you play a game. Next she told the players that she was going to show them how to play some games and that soon they would know some good games to play. The E than reached into her game box, took out a handful of pennies and said,

"See all this money. Do you know what we call this Kind of Money? That's right, we call this money pennies. Now we are going to play a game called the Penny Game. It's lots of fun. I will hide some pennies and you will look for them. Do you know what I do when I hide a penny? I put it where you can't see it. You will have to look for the pennies. We will see who finds the pennies."

The E then took out a dozen opaque white paper cups and put them upside down on the table with pennies under some. Then she lifted one up and asked the players if there was a penny under it. When the players said "No", the E replied "No, no penny." Then she lifted a second cup and asked the players what they saw. There was a penny there and when the players said, "A penny", the E replied, "Yes, that's right, there is one penny under this cup."

The E then told the players that they were ready to play the game. She asked them to hide their eyes, some demonstration and help were needed here. The E hid pennies under all but three of the dozen cups. When the players opened their eyes the E asked them to put both hands on their knees. She demonstrated and then she explained how to play the Penny Game. She told the players to listen so that they would know how to play the game (General Game Skill A- behavior while the game controller is explaining how to play the game) The specific rules for this game were as follows:

(1) the player had to keep his hands on his knees until the E called his name, then he was to look under a paper cup. (General Game Skill B- plays in turn)

(11) The player had to say "one penny," if he found a penny and had to put the penny on the table in front of him.

(111) the player had to say "No penny", if he did not find a penny.

(1V) the player had to replace the empty cup upside down on the table.

The E then called the first player's name saying, "Robin, it's Robins turn first to look". The E helped the player to respond correctly, to replace the paper cup, and to put her hands back on to her knees. This procedure was repeated for each player (its B's turn second, third) until all the pennies had been found. Next the E suggested that they find out who had found the most pennies. She asked the players who did they think had found the most pennies. One player said you could count but he did not know how, none of the players knew how to count. The E then counted each player's pennies and told the player who had the most pennies that he was the winner.

Next the E showed the players that one way to tell who had the most pennies was for each player to put his pennies in a line and to see who had the longest line.

"Who has the longest line? A's line is longer than B's, look she has one penny more than B. But look at C, his line is even longer than A's, he has one, two pennies more than A. We call the one who has the most pennies in this game the winner, C is the winner of this game, let's play again and see who wins the next game."

In the second game the E followed the same procedure except that she used different phrases to signify a player's turn, e.g., "It's your turn." "Joey's turn", "Robin, you're second, your turn now", "Jimmy, you're next, you're third."

At the end of the fifth game the E asked the players to hold up their fingers to show her how many games they had won. There was much uncertainty. The E then suggested that they write down the winner at the end of each game. She took scorecards out of her box which were marked off into 16 squares. She put a scorecard in front of each player and showed them how a star could be put into a square each time the player won. Then the E reviewed the five games and gave stars to the players who had won each game.

The time was almost up. The players played one more game and then the E showed them a pack of Animal Cards and told them that the next time they came they would play this game and that they could play the Penny Game again too.

Note: We do not advocate any set procedure for any session. Instead the game controller should use game and quantitative terms as opportunities to do so occur. The game controller should define words in terms that the players can grasp easily e.g., "rules tell you what to do when you play a game", "winner is the one who has the most pennies", "turn is when you look under a cup", "hide a penny . . . put it where you can't see it."

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TITLE

The use of games to facilitate the learning of basic number concepts in pre-school educable mentally retarded children.

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ABSTRACT

Purpose: To determine whether small group games could be used to facilitate the learning of basic number concepts in retarded children. The important feature of this training program was an emphasis on the intentional teaching of general game skills with number concepts being an integral part of the activity but incidental to the intentional teaching of game skills.

Procedure: Subjects in the Experimental Group participated in a game training program for 100 minutes per week for nine months while a matched group of Control subjects spent an equivalent amount of time in traditional pre-primary and primary arithmetic programs. The subjects were measured on knowledge of number concepts and general game skills prior to, during, and immediately following the game training program.

Hypotheses: Subjects who participated in the nine-month game training program would show more improvement in knowledge of number and in general game skills than would subjects who were given a traditional arithmetic program.

Results: The data provided substantial support for the facilitative effects of small group game activities on the learning of basic number concepts and the acquisition of general game skills.